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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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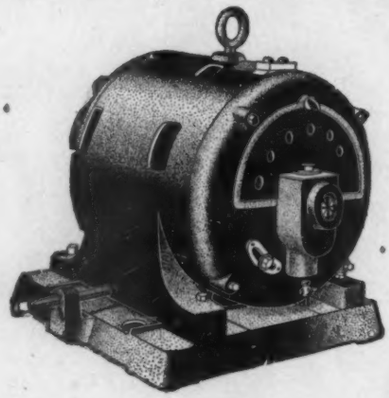

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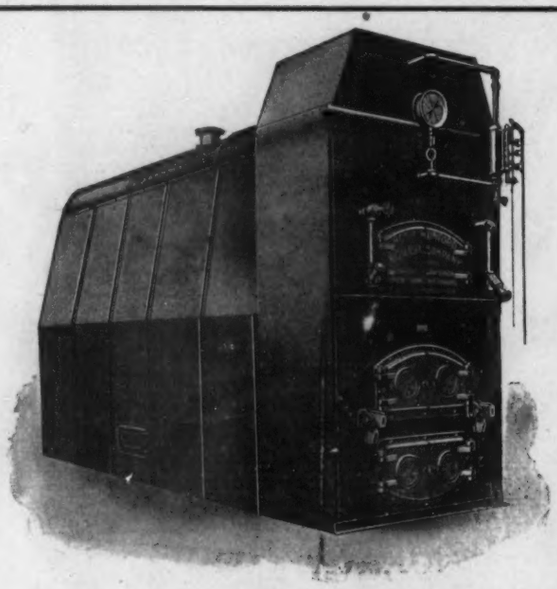

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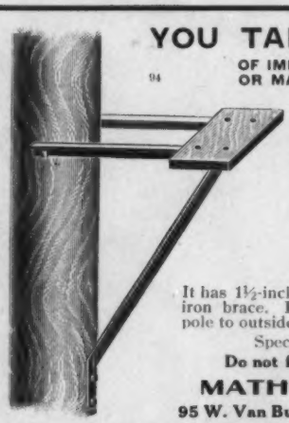

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POWER AND GAS

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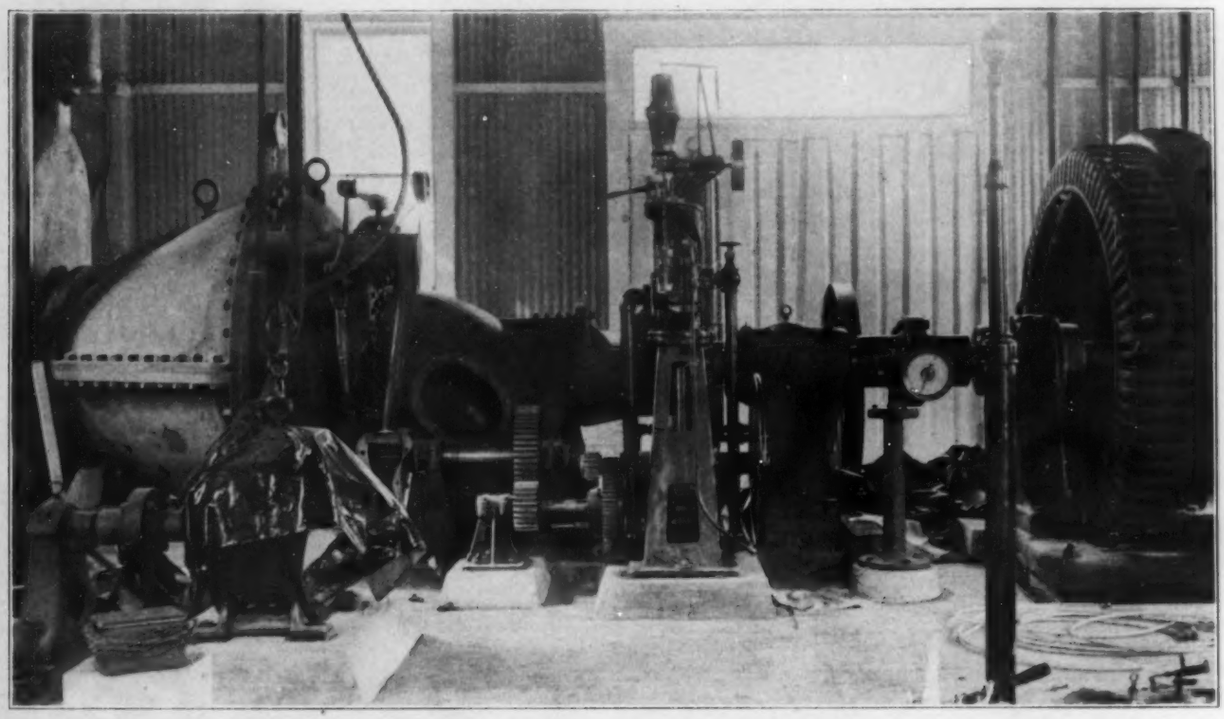
VOLUME XXIII. SAN FRANCISCO, JULY 3, 1909 NUMBER 1

LA GRANGE POWER PLANT.

BY GEO. S. DYER.

Electric power for the town of La Grange, California and a gold dredge nearby is supplied by the recently completed hydro-electric plant of La Grange Water & Power Company, three-fourths of a mile from the town. The initial installation consisted of a 450 k. w. Westinghouse three-phase generator direct connected to a 800 h. p. Platt Iron Works turbine operating under a head of 200 feet.

In order to convey the water from the reservoir to the pen stock, it was necessary to again cross the county road by means of a tunnel 90 feet long. On the reservoir side was placed a wooden gate with screw attached for controlling water in the fore bay. Concrete piers were built on each end of the tunnel, which is lined with concrete for 10 feet on each end to prevent caving. Then through a ditch about 1500



Water Wheel and Generator, La Grange Power Plant.

The water supply is conveyed by 18 miles of flume and ditch from a diversion dam in the Tuolumne river. It follows the line of an old mining ditch built in the early days when labor was cheap and powder little used, there being miles of double rock walls puddled with clay.

At the lower end was built a reservoir having a capacity of 3500 inches daily. This was accomplished by building a dam 212 feet long and 30 feet high and by raising the county road in two places. To connect the old ditch with this reservoir, it was necessary to run an in-take ditch 490 feet long.

feet long, 4 feet on bottom, slopes two to one, and an average depth of 15 feet. This fore bay is run partly through a decomposed slate and partly through clay and gravel and is on a grade of 1/10 of one per cent.

The pen stock is built of concrete and is 16 by 16 by 16 feet with walls 14 inches thick at the bottom and 9" at the top. The floor is **V** shaped, the **V** sloping from the fore bay entrance to the opposite side where a 14" slum gate is placed. The pipe line enters the pen stock at right angles to the fore bay entrance and the bottom of the pipe is 1' above the bottom of the pen

stock. There are three different diameters of pipe used beginning at the pen stock. The first 400 feet is 48" No. 10 double riveted sheet steel pipe. It is then reduced to a 36" No. 10 pipe for the next 200 feet. The next 200 feet is of the same diameter but made of 3/16" steel at the end of which another reducer cuts the diameter down to 30". The next 200 feet is built of 3/16" steel 30" in diameter. The last 200 feet is 1/4" steel 30" in diameter.

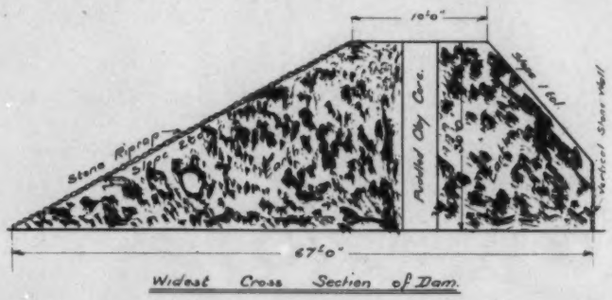
At this end a 30" cast iron **Y** splits the pipe into two 30" pipes, one for each water wheel. The pipe

Flume Crossing Hatches Creek.

line crosses the Turlock Irrigation Canal about 200 feet above the power house, therefore it was necessary to bridge it.

The pipe line was run almost the entire length through a cut and after completion tamped and covered with earth. In the line there is one horizontal and three vertical angles. The horizontal angle of 18 degrees was put in to avoid running a long cut through hard rock. The pipe is anchored by concrete piers, iron straps and stone piers. There are two 4" air valves and one 3" stand pipe, one air valve on the 30" 3/16" pipe, one on the 36" No. 10 and the stand pipe on the 48" at the reducer. This 1200 feet of pipe line gives 200 feet head.

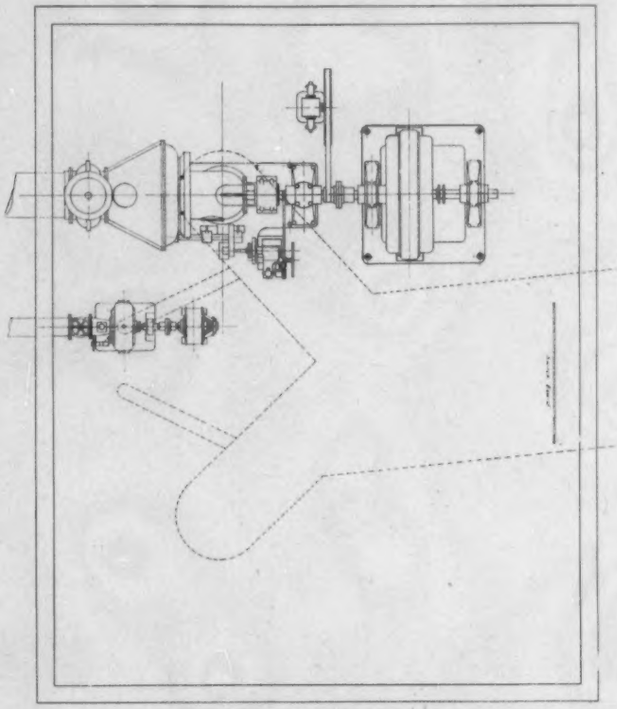
The power site was chosen on the Tuolumne river at just above maximum high water. On account of loose formation it was necessary to excavate a great deal more material than would otherwise have been necessary. All construction up to the power house and including power house foundation was made for two units. The main tail race leading to the river is about 12 feet wide and 40 feet long, the average depth being 8 feet. The foundation required about 400 barrels of cement and about 400 yards of river



Widest Cross Section of Dam.

sand and gravel in order to bring the power house floor to the proper level and to raise the 12-inch side walls above the floor 3 feet 6 inches as an extra precaution against high water. The mixture in the walls and at all places where the cement would be liable to wear one to six; for inside filling the ratio was one to nine.

The tail race to the power house is led out on the same plan as the **Y** of the pipe line, it being built in this manner to drain from each water wheel unit. The main part of the tail race inside of the foundation is 10' wide, 12' long and 14' high. The two wings



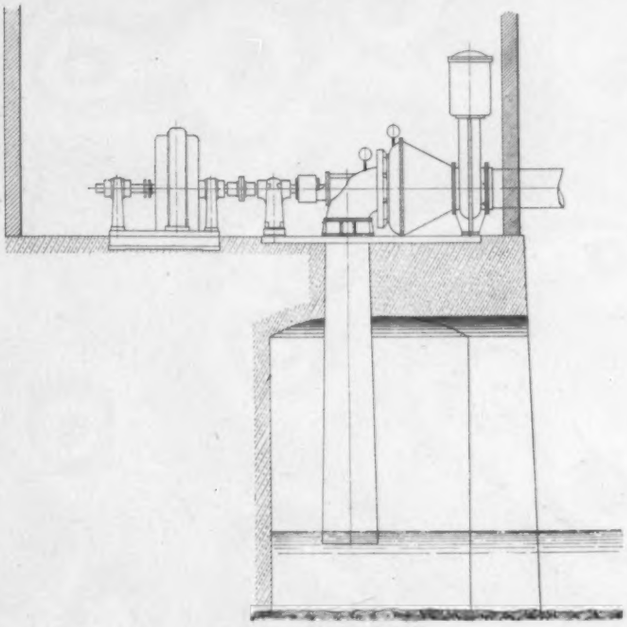
Plan of Power House

are 5' wide, about 10' long and 14' high. The top of the cement work is arched and in these arches about 6 inches from the outside of the arch was placed 4½ tons of old railroad iron. Down through the center of the foundation and leading from the back of the power house into the tail race a 22" waste water conduit was placed to receive the discharge water from a 9" Lombard relief valve. Rock was used all through the concrete work, sizes varying as the volume of concrete permitted.

In the floor of the power house paper conduits were placed for all interior wiring and water pipes were so placed that hydrants could be located at different parts of the power house both inside and out. On top of the 3'-6" side walls which were brought up from the foundation, sills 4" x 12" of Oregon pine were

Tail Race

bolted, upon which the 4" x 12" studding were placed. At the top of these 4" x 12" studding on two sides of the power house, notches were cut 6" x 3', and on these shoulders 6" x 6" timbers were bolted and 40-pound steel rails were set for a traveling crane. On top of the studding the 6" x 6" plates were placed to which the tie beams were bolted. The rafters and tie beams were constructed on a truss plan and bolted together, the size of timbers used being 6" x 6". All the wood work in this building is of surfaced Oregon pine, except window and door casings which are of



Section of Power Plant.

redwood, and after completion received two coats of white lead and oil. The outside covering is corrugated iron.

A 30-inch hydraulic valve connects the pipe lines to the water wheel chute. The hydraulic valve, water wheel chute, one quarter turn of draft tube and outboard bearing are all mounted on one solid cast iron bed plate. The draft tube, which is 18' 6" long and flared from 2' 9" top to 3' 6" on bottom is riveted to the quarter turn; on the water wheel chute there is mounted a pressure gate and on the quarter turn of the draft tube is mounted a vacuum gauge. The water wheel is a type B 31" Platt horizontal wheel, and was sold under a guarantee to develop 800 horsepower under 215 feet effective head at 450 r. p. m., and to consume 2460 feet of water per minute. By a test made later it was found to even exceed this guarantee.

The gate rigging of the water wheel is controlled by a type Q Lombard governor direct connected to the rigging through gears. On a 12" pipe tapped from the main pipe line between the hydraulic valve and the **Y** of the pipe line a 9" Lombard relief valve has been placed, the regulating valve of which is located inside the power house. From this 12" branch in the main pipe line a 9" tap is taken off for the Exciter water wheel, which is a 30 h. p. type C wheel operating under the same guarantee as the main water wheel but designed to run at a speed of 1120 r. p. m.

Forebay Cut and Tunnel.

The main water wheel is direct connected by a solid flange to the 450 k. w. generator, which is a two bearing water wheel rotating field type, running 450 r. p. m., 11,000 volts, 24 amperes per terminal, 3-phase 7200 alternations and according to test made at factory is supposed to develop the following efficiencies: Full load 94%, ¾ load 93.2%, ½ load 91.1%, ¼ load 84.5%, ¼ load 94.5%, deducting 5.1 k. w. for friction and windage.

The exciter water wheel is also direct connected, the exciter being a type S compound wound machine, 12.5 k. w., 125 volts, 100 amperes and designed to run at 1100 r. p. m.. The wires connecting generator and exciter to the switchboard are carried through paper conduit under the floor. The high tension cables are No. 4 stranded and insulated with rubber for 15,000 volts.

The switchboard is composed of two panels, one for the alternating and one for the direct current, and are Westinghouse standard type. On the alternating current board is mounted a polyphase indicating watt meter, a type F ammeter with plugging device for testing, one type F voltmeter on extended arm, also arranged with plugging device for testing, one type D field ammeter, field rheostat handle (resistance being distance controlled), one two-pole single throw field switch and one synchronizing lamp, plug and handle for type E automatic distant controlled three-phase switch, which is mounted in concrete cells on a platform to the rear and above the switchboard.

On the direct current board is mounted one type E ammeter, one type D voltmeter and one three-pole double throw exciter switch, (rheostat, and two single throw, two pole, light switches for controlling power house lights.

From the type E three-phase switch the power is

Completed Power House

carried along the wall by No. 4 15,000 volt rubber covered cable through paper conduits to the end of the power house where it passes to the outside structure through 10" terra cotta pipe placed in the wall. On this end of wall where line passes through there is placed a Westinghouse low equivalent lightning arrester.

The pole line which carries power to the gold dredger is 3.6 miles long and consists of 35 foot poles with 7" top, 120 feet apart. The longest span in the pole line is 175 feet. The bottom of the poles were treated with three coats of crude oil, the tops housed and painted with three coats of Princess metallic paint and boiled oil. They were placed six feet in the ground and tamped with 5 gallons of crude oil. The top construction is of the isosceles triangle style, eucalyptus pins being spaced with three-foot centers. The cross arms are of Oregon pine, cross arm pins being the ordinary 9" round pin. Poles were tapped 1-inch for cross arms and two ½" bolts fasten them to the pole. The top pin is 16" in length, the first 12' of base being 1½" square, top being turned off and threaded to receive the insulator. These pins are held to top of pole by two ⅜" bolts. The insulators are of the triple petticoat white porcelain type.

The line which is carried in top groove of insulators is No. 6 hard drawn copper. All angles in pole line are anchored by 5/16" galvanized stranded cable, two breakers being cut in and each guy ground end being fastened to ⅝" x 8' eye bolt on the lower end of which a 8 x 10 x 12 oiled redwood timber is placed and buried 6 feet deep. The telephone line is No. 12 galvanized iron wire placed upon double petticoat insulators tested for 6,000 volts. The main power line is transposed every ¼ of a mile and the telephone line about every 1000 feet.

About ¼ of a mile from the power house, a tap is taken from the pole line and run through three single pole switches and then through two k. w. 10,000 volt to 220 volt O. D. transformers, from which the town of La Grange receives light and power. About 2½ miles from the power house another tap is taken off and run through similar switches and transformers cutting voltage from 10,000 to 440, for the dredge machine shop. At this station there is also a 3 k. w. O. D. transformer which cuts voltage from 440 to 110 volts for lighting the camp. At the end of the pole line, the line enters a Westinghouse 3-pole oil switch, and from there into the dredger sub-station in which there is placed similar lightning protection as in the power house; also three 125 k. w. 10,000 volt to 2200 volt oil-cooled transformers.

From the sub-station to the cable pole at the dredge, which varies in length as dredge moves along, the secondary pole construction is similar to the main line. The power is carried from cable pole to dredge through an iron armored three conductor cable. The dredge end is fastened to a three pole terminal board from which the power is carried through ordinary stranded three conductor cable to the main switch which is a Westinghouse type B and is controlled from the receiving panel on the switchboard.

The main switchboard is composed of one receiving panel and two distributing panels, one for the 2200 volt circuits and the other for the 440 volt circuits. At one end of the main switchboard a small lighting panel controls all the lights of the dredge. The electrical apparatus on the dredger aside from the switchboard is as follows:

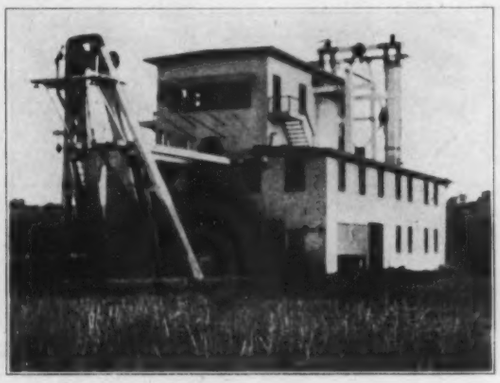
Three 50 k. w. 2200-volt to 440-volt O. D. transformers for the smaller motors, one 10 k. w. 2200-volt to 110-volt O. D. transformer for lighting system only, one 100 h. p. 2200-volt type F variable speed motor for main drive, one 100 h. p. 2000-volt C. C. L. motor for main pump, one 75 h. p. 2200-volt variable speed variable motor for main winch, one 20 h. p. 440-volt motor for ladder hoist, one 100 h. p. 2200-volt C. C. L. motor for sand pump, one 25 h. p. 440-volt type F

type C. C. L. motor for stacker drive, one 30 h. p. 440-volt type C. C. L. motor for screen drive and one 10 h. p. 440 volt type C. C. L. motor for primer pump.

The constant speed motors are all started by their respective oil switch auto starters placed near the motors. The variable speed motors are all controlled by their respective controllers from the winch room, where the main switchboard is located, so that if necessary the winch man can also stop all motors from one point.

This dredge is known as a 7 foot bucket dredge and is capable of excavating about 120,000 cubic yards of material per month. All of the power on this dredger is carried to the different parts through three conductor three-wire cables suspended by porcelain cleats. All these cables, the main power cable, the main power line, and all high tension power cables were furnish by the Standard Underground Cable Company. All main line insulators, cross arms, pins, brackets and porcelain insulators used on dredger were furnished by the Western Electric Company.

After the plant had been in operation several months a test was made under the direction of O. C. Goeriz, of San Francisco, representing the Platt Iron Works, and R. A. Guliac and the writer, representing La Grange Water & Power Company.



La Grange Gold Dredge

From Mr. Goeriz's report the following was taken: It was found that the effective head was not 215 feet as per contract and as the velocities of flow are subject to the square foot of the effective head it is evident that the reduced head will call for reduced speeds, proportionately to the square root of the respective heads, therefore the speed of unit was changed according to the effective head. In the test the pressure varied from 75 lbs. to 77 lbs. and the vacuum from 12" to 16.5" pressure gauge, distance above shafe being 3.75 feet. These variations of pressure and vacuum cause a variation in the head of from 193.4 to 195.9. The volume of discharged water was measured by a wooden weir placed in the tail race and built according to standard rules. Water height was taken by hook gauge. Volume was figured by the Francis formula.

TEST.

Test.	R. P. M.	Head.	Cu. ft.	W.H.P.	E.H.P	Tl. Eff.	Gen. Eff.	P.
1	455	193.7	41.6	915	697	76.7	93	81.8
2	430	194.8	43.5	963	750	77.9	92	84.6
3	430	194.8	43.5	963	763	79.3	92	86.3
9	426	195.9	29.3	652	412.5	63.3	90	70.4
11	418	195.1	32.3	715	493	69.	92	75.
13	426	195.7	26.7	594	352	59.2	89	66.6

PEAT FOR FUEL.

A number of cities and towns in the United States may obtain their light, heat and power direct from peat bogs in the near future. The statement is made by Federal experts that millions of dollars' worth of fuel lies undeveloped in the swamps and bogs of the country, awaiting only the genius and business ability of the American before it drives the wheels of progress. Its value, on a basis of $3 a ton, roughly guessed at by experts of the Geological Survey, who have been studying the peat deposits for some time, is more than thirty-eight billion dollars—more money than is represented in all the property, stock, implements and buildings owned by the farmers of the United States.

With the coal supply being used at a tremendous rate, peat is expected to become a most important auxiliary fuel and one that will prolong the life of the coal itself. An important fact which leads the experts to believe that peat will soon come into quite general use in certain parts of the country is that it is as a rule found in quantities in regions far removed from the coal fields, so far that the cost of transporting the coal amounts to several times the cost of the fuel itself at the mines.

The States containing the greatest amount of peat are the eastern Dakotas, Minnesota, Wisconsin, Michigan, Northern Iowa, Illinois, Indiana, Ohio, New York, the New England States, New Jersey, portions of Virginia, North and South Carolina, Georgia and Florida.

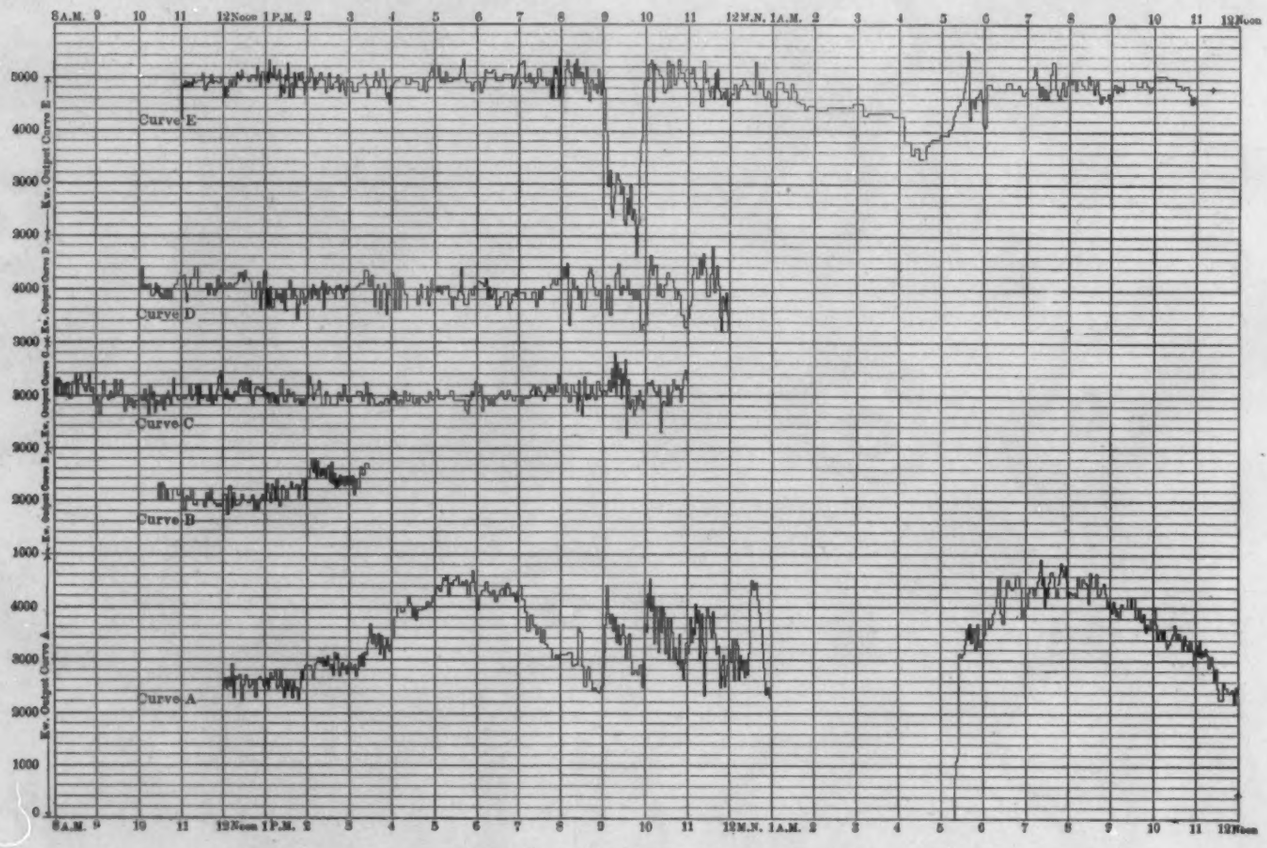
A thorough investigation of the peat resources is now being undertaken by the Geological Survey, not only as to the amount of peat and its location, but also its use. Prof. Charles A. Davis of the Technologic Branch has general charge of the investigations, while Prof. Robert H. Fernald, consulting engineer in charge of gas producer tests, is endeavoring to find the value of peat as a fuel for heating and power purposes. The latter but recently returned from a trip to Europe where he investigated the uses of peat and found the older countries much farther advanced along this line than the United States. Prof. Fernald returns with the belief that peat will soon be extensively used in the United States. In Ireland, he found that peat was being used generally for domestic purposes, but not by the manufacturing establishments. "Sweden is dotted with peat deposits and its bogs are now being extensively utilized for power purposes," says Prof. Fernald. "During the last eight years new bogs have been constantly added to the list until bogs producing from 2000 to 5000 tons of dry peat for power purposes per year are found on every hand. The consulting engineers who have installed some of these plants are unquestionably working in the right direction, placing the power plant directly in the peat bog and transmitting the electric current to the surrounding towns. The current is being used for manufacturing purposes and also for lighting both the streets and houses. The installation of the power plant in the bog or at the mine has been advocated in this country by the Technologic Branch of the Survey for installation of several thousand horsepower only, yet this principle is applied in Sweden to small plants and may be feasible in certain parts of this country.

FUEL ECONOMY TESTS AT REDONDO PLANT.

Mr. C. R. Weymouth recently presented a paper before the American Society of Mechanical Engineers in which he describes tests made at the Redondo plant of the Pacific Light and Power Company near Los Angeles, California. [1]These tests were conducted for fifteen days on a variable railway load, and also under various uniform loads. The results of these tests are summarized herewith together with the author's answers to various questions raised during the discussion as published in the Journal of the American Society of Mechanical Engineers for June, 1909.

ical engineers. With modern systems for central station records and cost-accounting, it cannot be that, the engineering public might search in vain the proceedings of our leading engineering societies, and even the technical press, for an authoritative statement of plant fuel economy in regular every-day service in any of these notable central stations.

During recent years there have been pronounced differences of engineering opinion regarding the selection of prime movers, and while these differences do not center on the question of fuel economy alone, this is, in most cases, a prime factor. It has become a cus-



Load Curves

In the table is given a summary of all the observed data and the calculated results for the various tests including averages of steam pressure at engine throttles, superheat at engine throttles, condenser vacuums, circulating water temperatures, etc.

THE AUTHOR. While the interest in this paper as evidenced by the discussion is very gratifying, it is disappointing that for purposes of comparison specific statements of economy have not been given for some of the more important Eastern and Western power stations.

During the last six or eight years, the steam-power central station has experienced apparently a wonderful development, and the fuel economy of these large stations is a matter of supreme importance to mechan-

privately, this subject has not received its full share of attention and study; yet, with perhaps one exception, tom in the selection of such apparatus to compare the steam consumption guarantees for various types at specified ratings, making reference to actual shop and plant tests as a warrant for the guarantee. It is a fact, however, that the final measure of economy is in the monthly maintained station fuel records, under actual service conditions and covering a wide range of load, rather than in shop or uniform-load tests. The engineering public are far more interested in these commercial fuel economics, than in mere statements as to steam consumption under ideal test conditions, or in speculations as to probable fuel economy on an assumed steam economy; and in passing judgment on a matter of such importance, they are entitled to such fuel performance records.

[1]See Journal of Electricity, Power and Gas, Aug. 22, 1908.

The results of the official fifteen days' tests of the Redondo plant were obtained on a commercial run under rapidly swaying railway load, and including all standby losses for each day during the four and one-half hour period of shutdown. It is common knowledge that there is a large discrepancy between such commercial load records and shop or uniform-load tests, a feature apparently overlooked by some members in discussing this paper.

The Redondo station operates in parallel with a waterpower station of about equal capacity. Practically all of the total load-variation is taken up by the Redondo engines, and as these swings correspond to those of a plant of double capacity, it follows that the rate and magnitude of load variations on each unit are about twice as great as on an ordinary or independently operated steam plant.

The writer has been keeping careful note of the monthly economy of the Redondo plant, in order to detect any failure, chargeable to the plant equipment, to maintain the economy as shown at the time of completion. There are external conditions—principally the intermittent failure of circulating water due to seaweed, and the operation of all or part of the plant non-condensing for intervals varying from a few hours to a few days per week—which for certain months have caused a falling off of the monthly economy by not more than from five to ten per cent.

But to answer properly Mr. Ennis, who apparently is under the mistaken impression that the record given was merely for a test condition, and who considers the economy stated "perhaps unprecedented if it is maintained in the ordinary operation of the plant," the writer can state that for the month of December, 1908, after seven months' operation of the Redondo station entirely under the direction of the regular plant operatives, the average economy, under similar conditions of load, etc., was even better than that obtained under the official test of the complete plant. Provided the plant upkeep is given ordinary attention, there is every reason to believe that the station will continue to maintain practically the same fuel economy; except during periods of unfavorable external conditions of the character outlined.

	Designation of test	Unit	Variable load average of 15-day tests	2000-kw. load test (Approximate)	3000-kw. load test (Approximate)	4000-kw. load test (Approximate)	5000-kw. load test (Approximate)	Variable load complete plant test
2	Date of starting test	1908	April 18	May 14, 10:30	May 19, 8 a.m.	May 18, 10 a.m.	May 5, 12 noon	May 21, 11 a.m.
3	Date of stopping test		May 4	May 14, 3:30	May 19, 11 p.m.	May 18, 12 m. n.	May 5, 1 a.m.	May 22, 11 a.m.
4	Duration of test	Hours	24	5	13	14	23	24
5	Time of starting fires			5:10 a.m.	3:00 a.m.	5:10 a.m.	4:35 a.m.	5:05 a.m.
6	Period of warming boilers	Hours		5:20	5:0	4:50	7:25	5:55
7	Average steam pressure at engine throttles	Lb. per sq.in.	180.03	183.	181.74	180.9	189.3	173.76
8	Average superheat at engine throttles	Deg. F.	82.46	87.99	92.	96.05	92.78	95.15
9	Average temperature circulating water inlet	Deg. F.	63.03	61.64	61.41	61.34	62.4	59.33
10	Average temperature circulating water outlet	Deg. F.	79.15	78.09	79.37	79.02	81.09	82.12
11	Average vacuum in condenser (Corresponding 30 in. Bar)	In. Hg.	28.334	28.426	28.343	28.214	27.976	27.784
12	Average temperature of feed water leaving heater	Deg. F.	146.9	184.3	167.8	155.9	150.7	177.22
13	Kilowatt output (including lights)	Kw-hr.	71615.24	11225.577	47126.457	58745.125	116899.748	215262.438
14	Deduction for lights	Kw-hr.	125.	26.042	78.125	79.917	117.792	
15	Net kilowatt output, deducting lights	Kw-hr.	71490.24	11199.535	47048.332	58665.208	116781.956	
16	Fuel oil as fired (334 lb. to bbl.)	Bbl.	303.387	50.01	195.458	244.783	496.910	957.566
17	Heat units per pound oil as fired	B.t.u.	17840.	17938.8	17920.8	17965.8	17838.	17717.
18	Sulphur in oil (by weight)	Per cent	2.34	2.17	2.43	2.39	2.49	2.60
19	Moisture in oil (by weight)	Per cent	2.38	1.82	2.08	1.895	2.70	2.59
20	Silt in oil (by weight)	Per cent	.14	.138	.14	.113	.10	
21	Fuel oil corrected as per contract	Bbl.	282.746	47.219	183.307	230.764	460.884	883.115
22	Economy (oil corrected as per contract)	Kw-hr. Bbl.	252.842	237.298	256.664	254.252	253.382	243.758
23	Economy (oil corrected as per contract)	B.t.u. Kw-hr.	24438.	26039.	24074.	24302.	24386.	25349.
24	Economy corrected only for heat units in oil	B.t.u. Kw-hr.	25288.	26742.	24857.	25027.	25347.	26320.
25	Number of boilers in service	No.	5	3	5	5	6	15
25	Additional fuel oil 2000-kilowatt test account idle boilers equivalent 5 boilers in use	Bbl.		50.339				
27	Calculated economy 2000-kilowatt test equivalent 5 boilers in service (oil cor.)	Kw-hr. Bbl.		222.482				
28	Combined efficiency of engine and generator based on separate exciter	Per cent		90.2	92.5	94.1	94.75	

Several members have expressed the idea that compared with Eastern coal-burning plants the excellent fuel economy of the Redondo station is to be attributed wholly to the superior boiler-plant efficiency, when burning crude oil, and not to the economical performance of the prime movers, which, either by inference or conjecture, they would class as ordinary.

It is important to distinguish between the high efficiencies resulting from an absolutely uniform-load boiler test under ideal conditions permitting refined adjustment, and the performance under constantly changing railway load, with heavy swings and including not

only a considerable period of operation at light load, but several hours of standby and radiation loss during each 24-hour period; and however good the gross boiler efficiency may be with oil fuel, there results a lower net boiler-plant efficiency, after making deductions for the steam consumption of oil burners, heating coils in oil-suction tanks, oil-pressure pumps and live-steam make-up in oil-pressure heaters, and after making the further uncertain allowances in the case of excessive moisture and sulphur in the oil, and loss by vaporization due to heating in suction tanks.

Judging by the various general statements, there unquestionably prevails an exaggerated idea of the difference between this net boiler-plant efficiency when burning oil fuel, and when burning the best brands of anthracite and semi-bituminous coals, under the every-day commercial service conditions described, and even when using the automatic system of oil-firing. In short, the economy of this plant in view of the necessary losses in its various elements, under regular service as compared with test-conditions, indicates that not only was the boiler performance remarkably fine, as correctly indicated in the discussion, but that the individual performance of every element composing the plant was necessarily of notable excellence.

In line with these considerations, Mr. Barrus and others have inquired for test data on the various elements of the plant. The only official tests made at Redondo are those given in the paper, and made under the control of the Testing Committee appointed by the contractor and purchaser. The only tests of individual elements were informal tests of short duration, in which the purchaser was not represented, and although they might be of service in estimating the performance to be expected in designing new plants they would not add to the value of the paper, when limited to the purpose for which it was written.

It seems to have been taken for granted by some that the writer is an enemy of the steam turbine, which is not so. All he desired was to bring out the fact that the piston steam engine is still an important factor in steam power plant design. On the present showing of Pacific Coast plants, he is compelled to favor the piston engine on the score of economy, but he does not wish to take a stand that either one or the other, or a combination of the two, will necessarily be the most efficient, when all the elements which affect the every-day working of a power plant are considered. Under constant full-load "test conditions" the steam consumption of engines and turbines may be nearly equal, but under commercial service and on widely varying loads there may exist a marked difference in the respective fuel-economy records, and fuel economy is really "the proof of the pudding."

In answer to Mr. Kent—colder circulating water can be had in the East than in the West, and as the economy of the turbine depends largely on the vacuum obtainable, turbine plants installed in the West with 70-deg. circulating water will not show as favorable economy, either in steam consumption or the "coal pile," as plants in the East, where circulating water is available for a season at 35 deg. fahr., and where a vacuum of between 29 in. and 29½ in. is then obtainable.

Mr. Ennis states that the best records for Eastern coal-burning turbine plants are between two and two and one-half pounds of coal per kilowatt hour. If, as is probaly the case, these stations are burning the best qualities of anthracite and semi-bituminous coal, then after making due correction for boiler efficiency, the Redondo station will still be ahead on the score of economy.

In estimating the probable economy of the Redondo engines, Mr. Ennis used a combined efficiency of engine and generator of 0.855, popularly assumed as a representative figure for steam engines, whereas that actually observed and stated in the paper is over 0.94.

Referring to the deduction of Mr. Bibbins, the writer again wishes to protest against theoretical considerations and calculated economies, either from prime movers to complete plants, or vice versa. Complete plant economy is not merely a product of engine and boiler performance, but involves many other well-known items of loss. There must be considered not only the uniform load test performance of boilers and engines at economical load, but also their poorer performance in the station on variable load, including light load and overload; and all other elements of station fuel-loss, including standby, starting and stopping, will decrease the actual every-day station economy, as compared either with the calculated full-load economy or that shown by a test of short duration. Hence, knowing the variable load economy of the complete plant, and, say, the boiler efficiency, the calculated steam consumption of prime movers will be too great if these other items are neglected. Also if the boiler and engine test performance are known, the calculated complete plant economy is far too good if the other items of loss are neglected. Comparing with actual service records, Mr. Bibbins' culculation of one kilowatt-hour on fuel-consumption of 21,000 B. t. u. offers an exampie of the confusion resulting from such false analyses. If Mr. Bibbins and Mr. Kruesi would present to the Society some actual station fuel records, of their respective companies, either for Eastern or Western turbine plants, they would add to our store of such information, and perhaps encourage others to come forward with the same sort of data.

The writer's suggestion, commented on by Mr. Ennis, as to the establishment of a standard for comparison of fuel economics for power stations, had reference to the extension to complete plants of the standard set forth in the report of the committee of the British Institution of Civil Engineers, which referred only to the performance of steam engines, under different initial and final pressures and temperatures. An extract from this report is given in Ripper's The Steam Engine, Theory and Practice, p. 300. This cycle is designated by the above committee as the Rankine cycle, and is best known under this name, although previously known as the Clausius cycle.

The writer would emphasize the important difference in application between the standard proposed by the committee of the British Institution of Civil Engineers, and that proposed by the writer. The former refers to steam motors only, and the lower limit of temperature is that measured in the exhaust pipe near the engine. The latter refers to complete plants, including steam motor, boilers and auxiliaries, and not

merely the prime mover; the lower limit is the initial temperature of circulating water and not the temperature in the exhaust pipe. The complete plant performance will depend on the efficiency of the condensing plant, and the nearness with which the vacuum appoaches the lower temperature limit established by the entering circulating water.

Referring to Mr. Bibbins' remarks on the performance of engines at fractional loads; owing to the increasing number of expansions, and the benefits derived from the use of superheated steam, the Redondo engines actually improve overrated economy, for a wide range of fractional load. And contrary to the prevailing opinion, a good vacuum is very desirable for high grade economy, the benefit on fractional loads being especially notable. This improvement in engine economy at the lighter loads was so marked that the fractional-load losses in the remaining portions of the plant were equalized, giving for a fairly wide range of load a practically uniform fuel economy for the complete unit of engines, boilers and auxiliaries. The popular conception of the performance of the average engine on fractional load is so decidedly contrary to this, that the writer feels that he has established a significant fact in giving the curve of complete plant fuel performers.

To the writer's knowledge there was no consideration of increased flexibility in the inception of the four-cylinder engine, but this feature is not therefore of any less importance. The combination of the four-cylinder engine with twin condensers combines features of the utmost value, when considering the continuity of station output with a limited number of units, and also when operating in locations necessitating frequent cleaning of or tube renewals in surface condensers.

For the frequent special conditions at Redondo, of failure of circulating water and stoppage of condensers by seaweed, the twin-condenser arrangement is of the utmost value, permitting the cleaning of each condenser, while the entire engine exhausts to the other, thus losing between one and two inches of vacuum only. When the supply of cooling water is completely stopped by seaweed, the ability of the engines to carry the same heavy overload non-condensing, and this with high economy, is likewise a feature of great value, for on such service the effective capacity of any prime mover is its capacity when operating non-condensing.

Mr. O'Neil is apparently surprised, not that the actual result was so good, but that the guarantee was so poor, and he feels that this difference reflects on the ability of the engineers to determine the guarantee. This guarantee was not based on a calculated economy; it included the elements of standby loss, and variable load running, on which no data were publicly available. On the other hand, the guarantee was based on what information could be secured as to the actual performance of existing stations burning oil fuel. The contractor's initial proposal stated that the calculated economy of the complete station based on individual guarantees of apparatus, and uniform load at rating, would be 240 k. w.-hour per bbl. of oil. As the existence of the Redondo station was dependent on the guaranteed cost of power, under commercial conditions of operation, its general manager later demanded a commercial load guarantee subject to a heavy penalty for failure.

Answering Mr. Moultrop's query as to the method of filtering cylinder oil from the feed-water, and the possible trouble from oil in the boilers, on account of the use of condensed engine exhaust as the boiler feed-water; owing to the limited supply of feed-water, it was impossible to break in the Redondo plant on raw water, and to throw the air-pump discharge overboard. An excess of cylinder oil was intentionally used in starting the engines, some of which passed by the feed-water filters and for a period caused the burning out of some of the lower row of boiler tubes. The quantity of cylinder oil was subsequently reduced so that the filters could remove enough oil to avoid difficulty with the boilers.

Most of the cylider oil used by the engine is fed into the high-pressure cylinders, and this is largely eliminated by the oil separator diaphragm on entering the engine receiver, and trapped to waste. The steam entering the low-pressure cylinder is consequently comparatively free from oil. As but a small amount of cylinder oil is directly fed into the low-pressure cylinders, the total amount of oil in the condenser water is relatively small and as easily cared for by the filters. The filters are not of the pressure type, but receive water under atmospheric pressure, which passes downward through the filter by gravity. There are two filters per engine, each about 4 feet in diameter by 5 feet in height. In each filter are four horizontal perforated diaphragms for the support of the filtering material—usually hay—with which the filter is completely filled. The discharge pipe is so arranged as to submerge constantly all of the filtering material.

This general plan of filtration is in use in all Pacific Coast steam engine power plants having surface condensers, and has been successful for a period of years, although the same result does not seem to have been accomplished in Eastern power stations.

In view of the scarcity of accurate data as to power-plant performance, and the great difficulty of getting authentic reports tending either to prove or disprove the claims for various types of prime movers, it is to be regretted that a commission of disinterested engineers has not been appointed, to co-operate with some government bureau in obtaining complete data pertaining to the economy of all important power stations. The report of such a commission would officially stamp the correctness, or the incorrectness of the economies claimed.

The writer is conversant with conditions in many Pacific Coast plants, and would be glad to co-operate with such a commission.

Titanium oxide for the magnetite arc is obtained from the rutile deposits in Nelson County, Virginia, which also supply the demand for feno-tinanium for steel manufacture.

Eye injury from mercury vapor lamps is attracting the attention of German physicians who find the light rays from this source cause inflammation of the eye-balls lining and produces parallysis of the retina.

WESTINGHOUSE MOTOR DEALERS' CONVENTION.

In the electrical industry, there exists a certain community of interest between the manufacturer, the central station, and the contractor or dealer. The manufacturer of electrical apparatus is in business for the purpose of making motors and other electrical apparatus; the central station is in business for the specific purpose of generating and distributing electrical energy, and the contractor, dealer, or manufacturer, of mechanical devices, using motors, are in the business which uses both the products of the above.

Each of the above, necessarily, is endeavoring to realize a profit upon its investment of time and capital. Each of the above interests have, of course, their own respective competition, and this competition has grown to such proportions that the main time and energy of the parties interested, are consumed in coping with it. The result is, that the possibilities of the advantages lying in active co-operation between these three interests, has been to quite an extent overlooked.

All application of electrical apparatus is the result of education and experience, and while a review of past efforts shows a phenominal progress made during recent years, a similar survey of the present day equipment of large factories and central stations, justifies the prophecy of a more rapid advance in the immediate future. The tendency at the present time is towards a more diversified or universal application of electrical apparatus; towards a higher efficiency or greater economy of operation and towards automatic control or "fool-proofness." All this new application and improvement, make it not only highly desirable but almost imperative that each of these interests should mutually recognize the other's welfare. This can be accomplished only by bringing together representatives of the interests involved, and by laying before these representatives the various problems and questions, demanding solutions and answers, and by taking up the recent improvements and the general trend of the progress made.

An initial step in this direction was taken by the San Francisco District Office of the Westinghouse Electric & Manufacturing Co., at a recent gathering held at the Hotel Argonaut, consisting of those various so-called motor dealers, contractors and central station representatives, who are more familiar with the Westinghouse products. While this gathering was of a local nature, nevertheless, it proved by the interest shown and the general character of the papers delivered, that a step in the right direction had been taken.

The following papers, and some which will appear in future issues of the "Journal of Electricity, Power and Gas" were presented at this gathering, the complete program of which appeared in the issue of the "Journal of Electricity" for June 19, 1909.

An independent oil pipe-line with a minimum capacity of 10,000 bbls. daily is to be built 60 miles to Port Harford, San Luis Obispo County, California, from Antelope Valley, with branch lines from the Coalinga, McKittrick, Midway and Sunset districts. The new line is backed by interests closely identified with the Union Oil Co.

THE SELECTION OF MOTORS FOR INDUSTRIAL PURPOSES.

BY R. H. FENKHAUSEN.

The type of motor selected for any given industrial service will primarily, be governed by the source of current available, for although commercial types of motors may be procured with almost any speed and torque characteristics desired, it is not always possible to obtain the desired characteristics in a motor suitable for the source of current at hand. Some direct current motors possess features not found in any motor for alternating current and some alternating current machines are applicable where direct current motors would be almost valueless. For example, it may be said that there is at present no alternating current motor commercially available, that will maintain other than the normal speed irrespective of load changes. The field for this class of service is held by the direct current shunt motor with speed controlled by resistance inserted in the shunt field, and present indications are that it will hold this field against its alternating current rivals for some time to come. Before describing the characteristics of the various commercial types of motors, the speed classification adopted by the American Institute of Electrical Engineers should be considered. Formerly motors were classed only as constant and variable speed, but owing to the wide variation in the methods of obtaining variable speeds, a more restricted classification becomes necessary, resulting in the adoption of four speed classes, namely: constant speed, adjustable speed, varying speed and multi-speed.

The constant speed class embraces all motors whose speed variation from no load to full load does not exceed a few per cent.

The adjustable speed class includes motors capable of wide speed variation, but which when once adjusted for a certain speed, will maintain it irrespective of load fluctuations.

The varying speed class includes motors whose speed is capable of adjustment for a given load but which vary inversely as any changes in the load.

Motors of the multi-speed class have two or more definite speeds, any one of which they will maintain constant under varying loads.

When attempting to identify a motor with one of the four classes just given, it is necessary that the controlling apparatus be taken into consideration, because it is possible for one motor to belong to two or more different classes depending on the type of control employed, as for example, the direct current shunt wound motor. This type of machine when used with a simple starting rheostat comes under the constant speed class, and when controlled by resistance inserted in the shunt field circuit, under the adjustable speed class. If, however, the speed adjustment is accomplished by resistance inserted in series with the armature, the speed is no longer constant under load variations and the motor may be classed as a varying speed machine.

Under the constant speed class of motors may be grouped the squirrel cage induction motor started

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[1] Paper read at Westinghouse Motor Dealers' Convention, San Francisco, June 14, 1909.

either by primary resistance or auto starter, the phase wound rotor type of induction motor with resistance in the rotor circuit designed for starting duty only, the direct current shunt wound motor with starting rheostat only, the synchronous motor and the differentially compounded direct current motor.

For all small and moderate sized constant speed drives and for most of the larger ones, the squirrel cage induction motor will naturally be the motor selected, even in locations where both direct and alternating current are available, because in addition to all the characteristics of the direct current shunt motor, the squirrel cage induction motor possesses many advantageous features peculiar to itself, among which are absence of moving contacts, and great durability.

As an example of the practical indestructibility of the class of motor I have in mind an installation of these machines placed in the shipyard department of the plant under my charge over eight years ago. In this department they have been subjected to almost continual overload, and the most possible abuse by unskilled operators, who habitually throw the auto starters to the running side first, on machines where the motor is directly geared to a heavy flywheel, or else place the starter in the starting position and leave it there, allowing the motor to run on greatly reduced voltage.

Notwithstanding this severe service the motors have required absolutely no repairs and no attention other than a weekly inspection at which the oil wells are filled if necessary, the motor wiped clean and the air gap tried.

The principal objection to the squirrel cage type of motor lies in its inability to exert a large starting torque without imposing heavy current demands on the system during the starting period. For service where large starting torque combined with moderate starting current is required the "phase wound" rotor type of induction motor is most suitable. The stator of this motor is identical with that employed in the squirrel cage machine, but the rotor is equipped with a three-phase "star" winding terminating in three collector rings which lead to an external resistance proportioned for starting duty only. The rotor winding itself is made of low resistance, resulting in good speed regulation, high efficiency and high power factor when running at full speed with the collector rings short circuited. During the starting period high torque and low starting current are obtained by the insertion of external resistance in the three circuits of the rotor. Early motors of this type had the resistance incorporated in the rotor structure, but as this prevented control of the motor from a distance, except by mechanical means, the present construction was adopted. Another valuable feature is that the heat dissipated in the resistance is remote from the motor windings. The wiring between the starter and collector rings being in circuit at all times, slightly increases the slip and lowers the efficiency of this type of motor, but this difficulty may be overcome by the installation of a switch on the motor itself by which the collector rings may be short circuited after the rotor is up to speed.

Great care must be used in the selection of the proper size of motor for a given service, because if too small a motor is installed the gradual deterioration of the windings due to overload will occur. On the other hand if too large a motor be installed there will be a considerable loss in efficiency due to the motor running lightly loaded. As a general rule, however, there will be found quite as large a tendency to overmotor the load as to overload the motor.

In direct current operation the installation of too large a motor results in nothing more serious than a few per cent loss in efficiency, but in alternating current work there is also a large drop in the power factor, because the power factor of an induction motor varies with the load and at light loads is very low. If many underloaded induction motors are connected to a system the regulation will be bad, and the electrical part of the generating equipment liable to be overloaded by the large lagging current drawn from the system.

Under certain conditions the installation of a larger motor is necessary to permit future extensions, increased production, etc. This condition may be met by the installation of one or more synchronous motors on the system, by means of which the power factor can be greatly improved.

The synchronous motor is best adapted for large drives, but as skilled attendance is necessary in order that the power factor of the system be kept properly adjusted, should only be installed where the proper attendance is available.

The characteristics of the direct current shunt motor are too familiar to require any mention in this paper and the differential compound motor although possessing absolutely constant speed, unfortunately has so low a starting torque that it has never come into extended use.

For single phase operation there are many types of constant speed motors commercially available, differing widely in design, but none of which possess the ruggedness and simplicity of the polyphase machine. Some of these types have the simple squirrel cage type of rotor, but require an attendant to restart the motor in case of failure of the current supply, while other types possessing self starting features do so only by the introduction of more or less intricate centrifugal devices, which are liable to cause trouble if tampered with by curious but well meaning attendants. Under the adjustable speed classification we find only the direct current shunt wound motor controlled by resistance in the shunt field circuit. Motors of this type are started by resistance in the armature circuit, but after once up to speed all variations, above normal speed are obtained by altering the field strength. As the motor speed for any given strength of field is practically constant, under all load variations, it follows that this type of motor is especially adapted for the drive of lathes, boring mills or other machine tools requiring constant rotary motion, at any given speed. A little consideration will show that motors controlled by armature resistance variation are unsuitable for this class of work, as work is often performed, on which the tool only cuts during a part of each revolution, as when a part of a circle is to be machined. With armature control

the speed of the machine would greatly increase during the part of the revolution that the tool was not cutting, with the result that the tool would enter its cut at far too high a speed, probably causing a broken tool or even shifting of the job due to the sudden jar. The same objection applies to all commercial methods of speed control now available for induction motors so that when machine tool drive by alternating current motors is decided on for any installation the best results will be obtained by using squirrel cage constant speed motors, driving the various machines either individually or in groups, and obtaining speed changes when necessary through the medium of cone pulleys or change gears. There are in the plant under my charge all types of machine tools driven in this manner, and as proof of the satisfactory service rendered, all new motors installed are of the squirrel cage type, although ample direct current is available, as seventy-five per cent of the direct current generating equipment is not in use.

Under the varying speed class of motors may be grouped the series motor either alternating or direct current, the squirrel cage induction motor controlled by variation of the primary voltage, and the phase wound rotor type of induction motor with variable external resistance in the secondary circuit. All motors of this class possess the characteristic features of high starting torque and decreasing speed under load. There is, however, this difference between the series and the induction types, that the speed of the series motor becomes excessive under no load, and is therefore unsuitable for belt drive, whereas the speed of the induction motor cannot exceed synchronism, and it may therefore be connected to its load in any manner desired, or even disconnected with a clutch without danger of the motor racing. This limited speed characteristic is of special value in crane service when lowering a heavy load with the power on, as the motor acts as a generator as soon as synchronous speed is exceeded, and not only exerts a powerful braking action but returns energy to the line as well. In many cases this braking action is utilized for lowering heavy weights, long distances, thus eliminating wear of the mechanical brakes which are kept in good condition for emergency use in case of failure of the current supply. As all motors of the varying speed class possess enormous overload capacity for short periods and are seldom used for more than a few minutes at their maximum capacity, it is not customary to rate these motors in horsepower. The usual rating is in pounds torque exerted at a given radius and in selecting a motor for any service, one possessing at least twice the maximum torque required for the work to be done should be selected.

For the sake of convenience a nominal horsepower rating is often given, based on the maximum torque, that the motor is capable of exerting continuously for thirty minutes without dangerous temperature rise. When selecting an induction motor for varying speed service the characteristics of the several types should be carefully considered, as the motor designed for continuous operation at reduced speeds, is materially different from the motor designed for occasional operation at reduced speeds. Motors of the former type have phase wound secondaries of high resistance and require large magnetizing currents, their slip at full speed is high and the power factor low and efficiency at all speeds low, but as torque is the principal requirement in this class of service and the motor is usually only used for intermittent service, the poor operating characteristics are no serious disadvantage.

For service where the motor normally operates at full speed and is only occasionally run at reduced speeds, the rotor is usually wound to a comparatively low resistance. This reduces the maximum torque of the motor, but gives it good power factor, speed regulation and efficiency when running at full speed and the external resistance is proportioned to give the necessary torque required at reduced speeds.

The induction motor with high resistance squirrel cage rotor, controlled by variation of the primary voltage, is adapted for operating the motors on the trolleys of traveling cranes, where the large number of trolley wires required for the wound rotor type of machine would be a serious drawback. With three motors on the trolley only seven trolley wires are required as compared with ten for direct current and sixteen for the wound rotor type of induction motor. To offset this simplicity in the wiring there is, however, the difficulty of switching the comparatively high voltages employed on the primary, especially in the small space available in crane controllers, and unless the segments and brushes are kept in good order there is danger of flash over between segments connected to adjacent taps of the auto transformers. The compound wound direct current motor also comes under the varying speed class, and finds its principal application in service requiring large starting torque, combined with faily constant running speed. For elevator service the controller is often arranged to cut in the series winding while starting and after the motor is up to speed disconnect it, allowing the shunt field alone to operate the motor at constant speed.

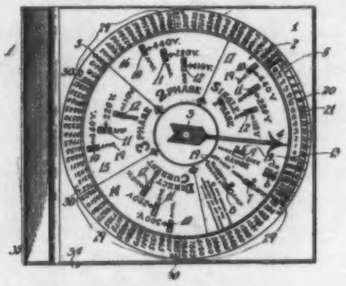
Motors of the multi-speed class are usually of special design, such as double commutator machines, etc., and hardly come within the scope of this paper. The subject of motor drive has been considered more from the electrical than from the mechanical point of view, but in selecting a motor for a given service a thorough understanding of the mechanical characteristics of the load, is absolutely necessary, if a satisfactory installation is desired. As an example of the varied conditions encountered the electrical drive of pumps and blowers may be taken. When these are of the centrifugal type there is always danger of burning up the motor in case of a decrease in the pressure pumped against, because the greatest load on the motor driving a centrifugal pump occurs when the discharge valve is wide open and zero pressure upon the pump, while the least load occurs when the pump is forcing water against the greatest pressure, that is with the discharge valve closed.

On the other hand a positive pressure blower or plunger pump requires power in direct proportion to the head pumped against and closing the discharge valve while the pump was running would probably wreck the machine.

A publicity department has been established by the Edison Electric Co. of Los Angeles, Cal.

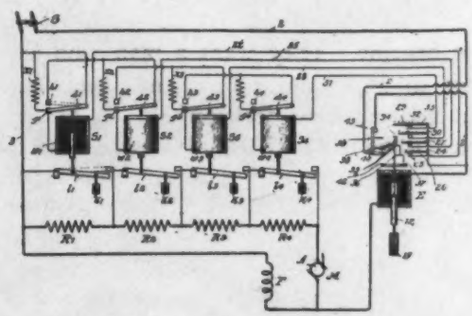
PATENTS

924,058. Calculating Device For Electrical Data, Etc. Louis E. Graves, Los Angeles, Cal. A device for the purpose set forth comprising a base member and a disk pivoted thereon, said base member having a main segment comprising two rows of marks side by side, and a supplementary segment comprising a single row of marks, these two segments being uncovered by the disk and occupying a complete circle, said base member having also a plurality of concentric groups of marks arranged in divisions in different angular positions and normally covered by the disk and said disk being also provided with an extra series of normally covered marks corresponding in length to the supplementary segment of uncovered marks, and a disk having an index for indicating the position of the disk with reference to the uncovered



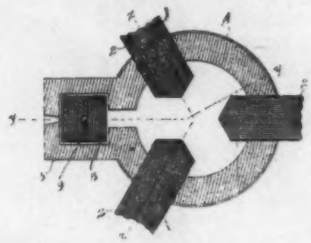
series of marks, said disk being provided with a plurality of openings in a main sector thereof to expose for reading the marks in the main division on the base member when the index reads on one of the rows of marks in the main uncovered segment on the base member and said disk having openings in a plurality of supplementary sectors thereof for exposing the marks in each of several different supplementary divisions of groups of marks on the base member when the index reads with reference to the other row of marks in the main uncovered segment on the base member, and said disk having in the main sector thereof an opening for reading in the extra series of normally concealed marks on the base when the index reads with reference to the supplementary segment of uncovered marks on the base member.

923,973. Electric Motor Control. Dugald C. Jackson, Madison, Wis., assignor to Dugald C. Jackson and William B. Jackson, Madison, Wis. The combination of a plurality of electromagnets, circuits therefor for connecting said magnets



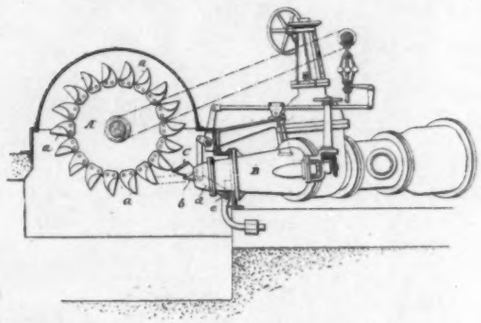
with a main circuit, one of said magnets being energized upon closing a switch in the main circuit, means controlled by the magnets after energization of the first magnet whereby said magnets are successively connected with the main circuit, and controlling means for causing disconnection of said electromagnets in reverse order.

924,603. Electrical Furnace. Louis D. Farnsworth, Palo Alto, and Max J. Bartell, San Francisco, Cal. In an electric furnace, the combination with the crucible thereof, of electrodes overhanging the crucible, said electrodes having inner ends normally of wedge-shape and said electrodes and crucible



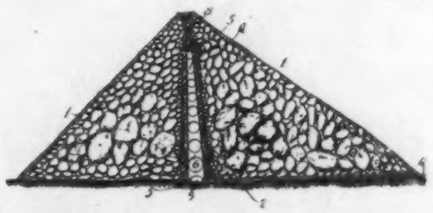
being arranged so that the current between the electrodes will pass downwardly through a body of slag, and thence across through the molten metal in the crucible, and a supplemental chamber at one side of the crucible in open connection with the latter, and into which chamber the molten metal will freely flow.

924,150. Impact Water-Motor. Robert M. Doble, San Francisco, Cal., assignor to Abner Doble Company, San Francisco, Cal. The combination with the nozzle of an impact



motor, of a deflector and a movable support therefor arranged to support the deflector above the jet and to carry it to and from the latter, substantially as set forth.

923,831. Dam. Newton L. Hall, San Diego, Cal. In a dam, a seal wall, the proportion of the width of said wall to its height presenting insufficient moment of stability to prevent overturning of the wall by the pressure of water exerted against its upstream face, said seal wall being formed with



upstream and downstream portions separated to allow access to the back of the seal wall, a rock fill on downstream side of the wall and exerting pressure against the downstream face of the wall, and spreaders transmitting the lateral pressure of the rock fill from the downstream to the upstream portion of the wall.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Free Engineering Advice

The increasing encroachment by the sales engineer into practice, hitherto regarded as sacred to the consulting engineer, is causing some unnecessary uneasiness. Modern competition has developed several aggressive business methods, among which may be mentioned the auxiliary engineering staff, maintained by many machinery houses. This service is freely placed at the disposal of the prospective purchaser, in the expectation that it will bring business. Naturally the salesman specifies the apparatus for which he is the agent, and if the design be correct and the price right, a sale may result.

If every purchaser did this, the consulting engineer, whose knowledge and experience qualifies him to advise and suggest on the installation of a power plant, would be ignored. For self-preservation, he must either seek new fields, or become the representative for a line of machinery whose cost is low enough to enable him to include his fee in the selling price. No staff is long maintained at a loss, except in the instance where a design is peddled among competitors, who may underbid the original price by substituting machines of their own make. It is the customer who ultimately pays the cost of the salesman's advice.

This method is proving satisfactory in numerous cases where no radical departure is made from standard practice. Any graduate of a technical school can trace a boiler setting and connect it to the manufacturer's drawing of an engine so as to make a presentable blue print. Power plant apparatus has been so standardized that this method often gives a good plant at a low cost. But where unusual conditions are encountered, where novel methods are to be tried, or where judicious economy is desired, the consultant is indispensible.

Certain men through fortuitous circumstances or natural ability, possess specialized knowledge which forms their stock-in-trade. Capitalists seeking the best return for money invested will retain such men to act as trusted guides throughout all the intricacies of an untried scheme. They want a man who is not subservient to any manufacturer, and who can give a prompt and unbiased decision.

Most of us will take the advice of a drug clerk as to a good medicine for curing a cold, whereas we would consult a specialist with regards to a more serious malady. There is more truth than fiction in the old saying that advice is worth just what it costs, and that there is nothing so expensive as what we get for nothing.

Many consulting engineers include the supervision of the operation and maintenance of a plant for a certain test period as a part of their contract, and by this practice have established a reputation for probity and reliability that can be assailed by no mere salesmen.

PERSONALS.

O. C. Goeriz, consulting mechanical engineer, leaves this week for a three weeks' trip East.

J. K. Firth, mechanical and consulting engineer, is now with the Joshua Hendy Machine Works of San Francisco.

H. V. Carter, president of the Pacific Electrical Works, Los Angeles, spent the early part of this week in San Francisco.

L. B. Cramer, secretary of the Portland section of the American Institute of Electrical Engineers, is a delegate to the national convention.

R. B. Daggett, manager of the San Francisco office of the Electric Storage Battery Company, has returned after an extended trip East.

Chas. H. Carter, vice-president of the Pacific Electrical Works, Los Angeles, was married at Los Angeles on June 23d to Bertha E. Heintz.

P. J. Aaron, manager of the Seattle house of the Western Electric Company, is celebrating the arrival of an eight-pound daughter which reached the northwest on June 22d.

W. S. Heger and R. B. Elder of the San Francisco office of Allis-Chalmers Company, have returned from a flying trip to the headquarters of the company at Milwaukee, Wis.

Sam H. Weidenthal of Weidenthal-Gosliner Company, left San Francisco last week for a two months' stay at Eureka, California, and vicinity on a combined business and pleasure trip.

Prof. C. E. Magnussen of the University of Washington is representing the Seattle Section of the American Institute of Electrical Engineers at the twenty-sixth annual convention.

Prof. Harris Ryan of Stanford University is at Frontenac, N. Y., as the delegate of the San Francisco Section to the national convention of the American Institute of Electrical Engineers.

Elam Miller presented a paper on the effects of electrolysis on telephone circuits which formed the basis for the discussion at the June meeting of the San Francisco Section of the Electrical Engineers.

H. F. Frosch, A. E. Drendell and Peter Decker of San Francisco start today on an automobile trip to Los Angeles, their plans contemplating about five or six days between San Francisco and Los Angeles.

George S. Davis, recently appointed editor of the Electric Traction Weekly of Chicago, is now in San Francisco in the course of a trip to cover the entire Pacific Coast in the interest of his publication.

On June 9th, at Binghampton, N. Y., occurred the wedding of H. A. Speh of the San Francisco office of the Western Electric Company to Hazel Halt, daughter of Mr. and Mrs. Grainger Hyer Comstock. Mr. and Mrs. Speh have returned to San Francisco and will make their home in Berkeley.

F. J. Lepreau, representing the Edison Manufacturing Company of Orange, N. J., spent the past week in San Francisco in the interests of the Edison-Lalande Battery Department of his company. Mr. Lepreau spent about five weeks in the Northwest and expects to devote a week or two to Southern California, returning east from Los Angeles.

NEW CATALOGUE.

The latest printed matter from the press of the H. W. Johns-Mansville Company is a folder entitled "Stucco Suggestions." It treats of J-M Albastic Stucco for exterior use and by way of illustration shows numerous residences on which this material has been used.

NEWS OF THE STATIONERY ENGINEERS.

San Francisco, No. 1 of California, N. A. S. E., has elected the following officers for the term beginning July 1, 1909: President, A. C. Arbuckle; Vice-President, P. L. Ennor; Recording Secretary, Herman Noethey; Financial Secretary, J. M. Wilson; Treasurer, D. Daniels; Conductor, John McCaul; Doorkeeper, F. H. Cherry; Trustees, Conrad Witzel, D. W. McCauley, Chas. Magnin; Delegates to National Convention, Chas. Bankey, D. Daniels, John A. Tillman; Alternates, W. H. Kearney, A. C. Arbuckle, Geo. James.

PACIFIC GAS AND ELECTRIC MAGAZINE.

A creditable house organ with the above name has been issued by the Pacific Gas and Electric Corporation of San Francisco. The contents for June include the following:

The New Electra Water Wheel, C. F. Adams; Landmarks in Nineteenth Century Progress, John A. Britton; Minimum Charges, Geo. B. Furniss; The Electric Meter Testing Department and Its Work, S. J. Lisberger; The Application of Reinforced Concrete Piling, H. C. Vensano; Accidents and Their Lessons, J. P. Coghlan; The Gas Meter, John Clements; The Office End, Chas L. Barrett.

The purpose of this publication is to foster a spirit of unity among all employes of the company.

OBITUARY.

Frank L. Davis, city engineer for Tacoma, Washington, died June 10, 1909, at Tacoma, after 20 years' connection with some of the most important engineering projects in the Northwest. He built the dam for the power plant of the Puget Power Company at Electron, and at the time of his death had been city engineer for six years.

Albert P. Brayton, president and organizer of the Pelton Water Wheel Company of San Francisco, died June 25, 1909, at his residence in Oakland, following a stroke of apoplexy, age 81, 10 months. Mr. Brayton was born in Jefferson County, New York; came to California via Isthmus of Panama in 1851, and since that time has been prominently identified with the foundry and machine business in California. Funeral services were held June 27, 1909, at his Oakland residence.

Adolph L. Selig, until recently assistant to the president of the Edison Electric Company in Los Angeles, which position he had resigned to become assistant general manager of the Great Western Power Company in San Francisco, died of heart failure June 22, 1909, at his home in Los Angeles, following an illness of two months. Mr. Selig was born in 1861 near Baltimore, Maryland, coming to Los Angeles in 1889, and during the twelve years in which he was in the employ of the Edison Electric Company, he rose rapidly from the position of collector to assistant to President John B. Miller. The funeral was held June 26th in the Scottish Rite Cathedral, in Los Angeles.

MT. HOOD RAILWAY AND POWER COMPANY.

With regard to article on "Power at Portland, Oregon," published in this Journal June 26, 1909, Mr. F. C. Finkle, their consulting engineer, states that the Mt. Hood Railway and Power Company never ceased work on its power plant at Bull Run, Oregon. After the money panic of 1907 and on account of some legal difficulties work was conducted on a limited scale during the year 1908, but never suspended. Since the more favorable condition of the money market and the clearing away of certain legal difficulties by a decision of the Supreme Court of Oregon and the enactment of new water legislation at the last session of the Legislature, beginning with the present year work has been resumed on a much larger scale, with the expectation of completing the first installation at an early date.

OUTING AT SANTA MONICA.

Starting the Ball Game

The electrical men of Los Angeles with their families and friends held an outing on June 19th at Santa Monica Canyon, where a day of recreation, sports, the consumption of immense baskets of home cooked food and the strict enforcement of the rule against "talking shop" relieved everybody from the strain of business and averted many a case of threa e.. brainstorm.

The events of the day are summarized in the following program:

PROGRAM.

Arrive at Camp 10 a. m.

10 a. m. to 12 m.—Ball Game between Contractors and Supply Dealers. Rubber boots and butterfly nets not allowed.

12 m. to 1:30 p. m.—Eat and get acquainted.

1:30 p. m.—Women's Race. None weighing over 250 lbs. gross, or less than 23 lbs. net, admitted to this race.

1:45 p. m.—Fat Men's Race. Contestants limited to one ton, and not less than 170 lbs.

2:00 p. m.—Girls' Race. Ages 10 to 87 (years not days)

2:15 p. m.—Boys Race. Ages 10 to 14 years. (Tommy Foulks barred)

2:30 p. m.—Men's Open Race. Age and weight don't count.

3:00 p. m.—Combination Relay Race. This is good; watch for it.

Special Event.

3:30 p. m.—100 Yard DASH by the following professionals:
H. B. Woodill, Tommy Foulks, Ira Francis, H. V. Carter, Arthur Ballard, Jim Lightipe.

3:45 p. m.—Dancing Contest. No one barred except Arthur Ballard.

4:00 p. m.—Babies' Contest, ages 3 months to 3 years.

4:15 p. m.—Awarding of prizes.

N. B.—To add to the pleasure of the event Benedict will not be allowed to sing. Charlie Carter, however, will favor the crowd with a "mellow" soprano solo entitled: Lohengrin's Wedding March.

The fact that Tommy Foulks was barred from participating in the boys' race clearly indicates the fine political work of some envious competitor. Tommy offered to run the race handicapped by a complete outfit of wiremen's tools, including a pair of climbers, but his application was given no consideration.

Arrival of the Picnic Party at Santa Monica Canyon.

The main feature of the outing was of course the women's race which was won by Miss Orth of the Western Electric Company. Long training in efforts to reach the bank before closing hours gave Miss Orth an advantage which her competitors were unable to overcome.

The baseball game was second only to the women's race and was won by the contractors who defeated the jobbers by a score of six to five. Arthur Ballard and Deacon Pyle officiated as umpires and as a result are no longer on speaking terms with the jobbers. During the game H. V. Carter and C. B. Clay covered themselves with glory by the professional manner in which they gathered in the flies, while H. B. George and W. M. Fagan won the applause of the women by lining out a home run each.

The prizes in the various contests were donated by the different electrical houses in Los Angeles and were of a very desirable character; they included some handsome table portables, curling irons and flat irons. The winners of the prizes were as follows:

Woman's Race—Miss A. Orth
Fat Man's race—1st, Geo. Wagner.
2nd, W. P. Cooper.
Girls' Race—1st, Vergie George.
2nd, Miss McCan.
Combination Relay Race—1st, A. L. Spring.
1st, Mrs. T. E. Burger.
2nd, Miss A. Orth.
2nd, Mr. Berryman.
3rd, Miss Mast.
3rd, Mr. Wagner.
Men's Open Race—1st, A. L. Spring.
Mr. Berryman.
Mr. Thomas.
100 Yard Dash—1st, T. E. Burger, Sub.
2nd, H. B. George, Sub.
3rd, H. V. Carter.
Jim Lightipe—not in yet.
Dancing Contest—1st, Mrs. Chas. Coulter.
2nd, Miss Olive Jurging.

Babies Contest—Eight babies entered; each one received first prize.

Great credit is due the following committees which handled the affair so successfully:

Transportation Committee.

Matchless LIGHTIPE Curly ARBOGAST Lovely CURRIER

Sports Committee.

Lonesome PYLE Solemn BAKER Noisy FAGAN

Director General.

Habitual Collector BOWERS.

TRADE NOTES.

A. Haase, president of the Western Steel Works, 313 Howard Street, San Francisco, can furnish crucible steel castings and make patterns for patrons desiring same.

The Delanoy Manufacturing Company, manufacturers and dealers in steam fittings, are now located in their new quarters at Nos. 292 and 294 Second Street, near Folsom, San Francisco.

The Weston Electrical Instrument Company, Newark, N. J., has opened a San Francisco office in the Bride Building, 682-684 Mission Street, in charge of Frank E. Smith, their San Francisco representative.

H. M. Hirschberg, president of the Excello Arc Lamp Company, has returned from Europe, where he found a general satisfactory condition in the flaming-arc-lamp field and many developments of great interest.

A movement is under way to organize a national association to represent the interests of the electric and gas fixture trade. A meeting for this purpose will, it is stated, be held within the next few months. John F. Byrnes, 324 Dearborn Street, Chicago, is closely identified with the movement.

Plans have been completed for an extension of the Duncan Manufacturing Company's plant at Lafayette, Ind., consisting of a five-story building 113 feet x 130 feet. The new factory will be fitted for turning out Duncan meters and new lines to be added, while the present plant will be used in the manufacture of Duncan transformers, which are now made in rented shops. The Duncan company has steadily employed from 100 to 150 men since 1901 with no shutdown, and when the new factory is completed 225 to 250 men will be on its pay roll.

INDUSTRIAL

New High-Pressure Pumping Station for Philadelphia

During March an important contract was closed by the city of Philadelphia for the equipment of a new high-pressure fire-service station, practically a duplicate of the Delaware avenue fire station which has been in service for a number of years past with great success.

The new plant will be located at Seventh and Lehigh avenues, in the Kensington mill district. It will use water from the old Fair Hill reservoir entirely, as it is located some distance from the river.

The work is in charge of the Millard Construction Company, which is the general contractor, while detail engineering work is being carried out by the Scofield Engineering Company.

The first contract covers ten 300-horsepower Westinghouse vertical single-acting gas engines, direct-connected to Deane triplex pumps; and in addition, a 140-horsepower unit for auxiliary purposes. The equipment is practically a duplicate of the Delaware avenue station. It will take its fuel gas from the city gas mains, and, as in the case of the Delaware avenue station, two large holders at different points in the city are available to be drawn on for the supply.

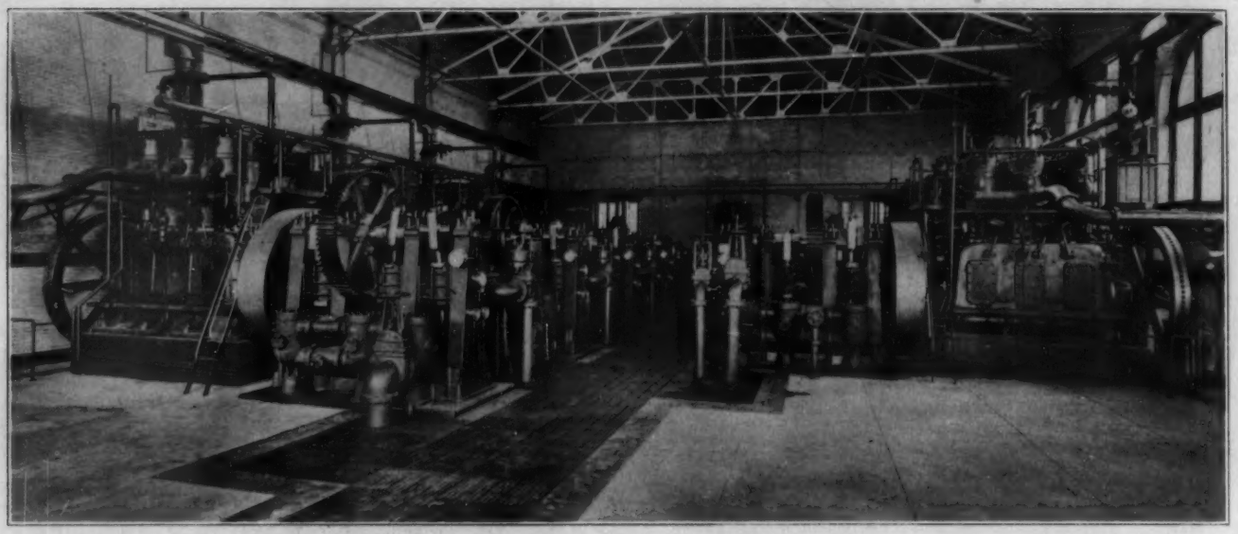
The decision to again employ gas-engine-driven pumps for this high-pressure fire-service, is distinctly interesting in view of the discussion which took place previous to and after the installation of the Delaware avenue station, and was mostly in favor of electrically driven pumps as established in New York City.

A study of the first year's operation (1904) of the Philadelphia station, shows the character of results that are obtainable from an installation of this kind. As this was the first year's operation of the plant, it was to be expected that the maximum interference from troubles, operative and otherwise, would be encountered. The year's record shows not a single case of failure to start, either in the actual fire service, or in the numerous experimental runs which were made to test out the equipment. During the year there were 32 alarms and nine actual services of any considerable duration, the services varying from a few minutes to 24 hours. The large pumping units ran 337 hours, and the small units 198 hours, during the year, with a total pumpage of 27,000,000 gallons. The average cost per thousand gallons pumped, including all the experimental runs, which were by far the major portion of the service, was 12.5 cents; but for a large fire of five or six hours' duration, the cost of pumpage is barely over five cents per thousand gallons. On the average, any units could be put upon the system at 300 pounds delivery pressure in from 45 to 60 seconds from the time of giving the signal from fire headquarters. And the entire station could be gotten under way in from seven to ten minutes. In ordinary operation, however, only one or two units are started on the first signal, as these are sufficient to start operations, and further units can be put on as the service may require. The cost of power is practically proportioned to the pumpage. The total cost of repairs on the gas engines, totaling 3000 horsepower, from their installation up to December, 1905, was $3.05. The system of compressed air for starting the gas engines, has never given out when called upon, and the storage pressure of 200 pounds may be replaced within one or two minutes after the starting of the single engine. In fact, seven large engines at Philadelphia have been started with only 98 pounds drop, without assistance from the compressor. In practice, several of the storage tanks are always held in reserve for use only in case of a serious break-down of the compressor.

Test of High Pressure Water System at Philadelphia.
City Hall in the Distance

Likewise, the gas supply has never failed. Considering that at least two large sources may be drawn upon, it is considered quite as dependable as electricity from underground feeders. The most interesting feature of the Philadelphia situation, is the attitude of the insurance authorities. Prior to the establishment of the Delaware avenue station, the insurance underwriters had imposed an additional charge of 25 cents per $100. On the completion of the test of the high-pressure pipe line, in May, 1902, a first reduction of 15 cents per $100 was made. On the final test of the gas-power station on April 18, 1905, the balance of the extra "pink slip" charge was removed and the system was declared approved. Formerly of a most decided conservatism towards gas engines, the authorities then expressed their complete confidence in the new system by suggesting extensions to the initial system. The closure of the recent contract brings these suggestions into material form and the net result will be a general reduction in fire rates in the districts affected, in addition to the protection afforded.

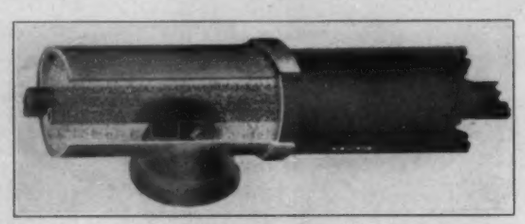
The accompanying illustrations show, in a general way, the character of the Delaware avenue station and the result of a test of one of the high-pressure streams at a point farthest from the pumping station, fifteen blocks from the river front. This station is under the control of the Department of Public Safety, Mr. Henry Clay, Director.



Delaware Ave. Station, Philadelphia High-Pressure Water System.—See Page 17

TEST OF J-M SECTIONAL CONDUIT.

The H. W. Johns-Manville Company call our attention to the following report of engineers to the Board of Trustees, Milwaukee County Poor, Milwaukee, Wis., of test made January 18, 1909, upon 1220 feet of conduit between engine room



J-M Sectional Conduit.

of Alms House and boiler room at hospital, which shows the efficiency of J-M sectional conduit:

Length of 3-inch high-pressure steam line draining to trap	1220 feet
Square feet of condensing surface in pipe	976 feet
Duration of test	178 minutes
Average steam pressure in pipe	67 lbs.
Average temperature of outside air	31° F.
Condensed steam discharged from trap	129 lbs.
Condensed steam per hour	44.1 lbs.
Condensed steam per square foot of pipe per hour	.0425 lbs.
Latent heat of 1 lb. steam at 67 lbs. pressure.	895 B. t. u.
Temperature steam at 67 lbs. pressure	318° F.
Difference in temperature, between steam in pipe and temperature	283° F.
Heat lost per square foot of pipe per hour	40.3636 B. t. u.
Heat lost per square foot of pipe per hour per degree	.1425 B. t. u.

ADOPTION OF TURBINES AT PORTLAND.

It is interesting to note that turbines have been adopted in the plant of the Portland Cement Company, at Portland, Colo., for power extension, rather than Corliss engines, two of which have already been operating for a number of years on surface condensers. The fuel used is a southern Colorado bituminous coal of rather poor quality. With the moderate superheat and high vacuum contemplated, it will be possible for the turbine to effect considerable economy in operation. Although direct current is largely used at this plant, an alternating current turbine unit was selected in connection with a rotary converter as providing greater flexibility of operation than obtainable with a direct current turbine unit which was also under consideration.

CUTLER-HAMMER MFG. CO. ACQUIRES CONTROL OF J. L. SCHUREMAN CO.

The Cutler Hammer Manufacturing Company of Milwaukee announces that it has purchased the plant, business and patents of the J. L. Schureman Company of Chicago; the manufacture of the well known types of Schureman controlling apparatus will be continued and all agreements and contracts made by the J. L. Schureman Company will be carried out by its successor.

The services of Mr. S. M. McFedries, general manager of the J. L. Schureman Company have been retained by the Cutler-Hammer Manufacturing Company and he will remain in active charge of the manufacture and sale of Schureman products. Under this new arrangement Mr. J. L. Schureman retires from the business. Mr. McFedries is well and pleasantly remembered by the many friends he made during his Pacific Coast trip about two or three months ago.

The Cutler Hammer Manufacturing Company are represented on the Pacific Coast by Otis & Squires of San Francisco and the transfer of this business will result in adding a new line to their already extensive business.

NEW TOOLS FOR LINE CONSTRUCTION WORK.

Mathias Klein & Sons, 95 W. Van Buren Street, Chicago, Ill., have added to their stock of linemen's supplies, line construction tools and material, a number of new appliances, including a leather tool bag for inspectors and electricians. This bag is made of russett leather, with welt seams, and

Klein Tool Bag.

is a very neat appearing article. It is provided with extension straps across the ends of the opening, so as to permit its being widened up when additional room is required. It has three retaining straps on the flap, and loops under the flap for carrying a saw. It is also provided with shoulder strap for carrying.

Made in the following sizes: 16-inch, 18-inch, 20-inch.

BUSINESS OF THE WESTERN ELECTRIC COMPANY.

Along with other industrial organizations which have reported substantial gains in business during the last two months, the Western Electric Company's April returns make a slightly better showing than March, which was considerably the best month in the fiscal year to that time, and April, 1909, is nearly 50 per cent ahead of the returns for April, 1908. In view of the company's steady expansion during the last ten years and the high record for the peak year of 1906, when sales ran up to $69,245,331, an increase of more than $25,000,000 over the preceding year, it is difficult to determine, in making comparisons, what shall be taken as the "normal" year, but at the present time the Western Electric is operating at the annual rate of 65 per cent of the record of 1906 and about 85 per cent of the record of 1907, which was the second best year in the company's history with sales totaling $52,724,168.

From the above percentages and with the business of the Western Electric running at the rate of $45,000,000 during the part of the current fiscal year which has elapsed, it would be conservative to say that at the present time the company is operating at about 75 per cent of what might be called a normal year. On the basis of April the sales are running at the rate of about $48,000,000 per annum, which would bring April's business close to $4,000,000. The first five months showed a rate of about $45,000,000 a year, but the company will undoubtedly make a better showing than this since the improvement to date is undoubtedly of a permanent nature.

Sales of the Bell companies are better than for a long time past and, while there is no indication of an expansion movement such as took place in 1906, the telephone companies are good buyers of copper wire, telephone apparatus and line material. The business in copper, cables and poles is particularly active. The excellent demand for telephone apparatus from the agricultural communities shows no signs of decrease and the demand from the railroads for telephone switching service continues to gain and promises to become one of the most important branches of the company's operations.

Demand for electrical supplies and electrical machinery is fully up to that of March and the business in small and moderate size motors and generators is the best in the company's history. This is partly explainable by the fact that manufacturers have found it more economical, especially in cities where current is cheap and easily available, to give up the use of steam power and run their plants by many small motors, which are easily moved about from place to place and consume current only when in active operation.

"The situation with its gradual and sound ratio of improvement looks very promising," said an officer of the company. "Of course much depends upon the crop situation, but there is no question that we shall run far ahead of last year and, with all things equal and from indications at the present time, we expect to make the best record, with the exception of 1906 and 1907, in our history."

The Western Electric's copper consumption has improved much of late, increasing from a figure considerably below 50 per cent of what might be called normal consumption, to over 50 per cent of the normal. Even at that, the amount of copper consumed is below a proportionate ratio to the rest of the company's business and is expected to increase considerably in the next few months.—Wall Street Journal, April 18, 1909.

NEW LIGHTNING ARRESTER BULLETIN.

The General Electric Company has issued Bulletin No. 4663 covering lightning arresters for both alternating and direct-current circuits. The arresters consist of a series of spark gaps shunted by graded resistances but without series resistance. The bulletin gives detailed information with regard to the various types of multi-gap arresters together with curves, illustrations, dimensions and connections, covering not only the arresters, but the auxiliary apparatus as well.

SUPPLY DEALERS CONSOLIDATE.

A consolidation of supply interests which promises radical changes in the electrical supply business of the Pacific Coast was brought about under date of July 1st and includes the following houses:

Pacific Electrical Works, Los Angeles;
Sterling Electric Company
Brooks-Follis Electric Company, Oakland.
Crescent Electric Company, Oakland.

The above consolidated interests have been incorporated under the name of The Pacific States Electric Company. The plans of the new corporation contemplate expansion on exceedingly broad lines, the intention being to thoroughly cover the entire territory west of the Rocky Mountains and to include houses to be established at Seattle, Portland and Spokane.

Details of the business organization have not yet been worked out, but it is expected that the new Company will be in full operation during the coming week.

MARSHALL PIPE END RECEPTACLES.

The Marshall Electric Company, Hyde Park, Mass., have recently added a large number of very important improvements to their pipe-end line.

This system is now completed with devices for sockets, rosettes, and switches.

No. 1203 Marshall Box.

One of the most popular of these new fittings is the No. 1233 which is shown by the accompanying cut. This goes in the No. 1203 box (½-inch size) or the No. 1204 (¾-inch size).

The wires go straight through without cutting and are very quickly inserted and connected to the binding screws. No pulling or twisting of the wires is necessary.

No. 1233 Marshall Pipe End Fitting.

The receptacle also includes a 2¼-inch shade holder.

The device is very attractive in appearance.

It is carried in stock by all the principal jobbers.

Samples will be furnished gratis to intending purchasers on application to the manufacturers, the Marshall Electric Company, Hyde Park, Mass.

NEWS NOTES

INCORPORATIONS.

FRESNO, CAL.—Fifty-seven Oil Company; capital stock $500,000; by San Francisco people.

CHEHALIS, WASH.—The Twin City Light & Traction Company of Chehalis has filed amended articles of incorporation.

SAN FRANCISCO, CAL.—St. Albans Oil Company; capital stock $10,000; by C. H. Holbrook Jr., W. L. McGuire, L. B. Williams and C. A. and L. M. Orr.

MODESTO, CAL.—Ceres Water Company; capital stock $10,000; by V. Whitmore, Dr. W. C. Pendergrass, William Stocks, G. F. Wood and J. C. Williams.

OAKLAND, CAL.—Alisal Oil Company; capital stock $1,000,000; by A. D. Clement, A. J. Moore and C. R. Nelson of Oakland; F. D. Burr and A. L. Leal of Livermore.

LOS ANGELES, CAL.—Los Angeles Gas and Electric Corporation; capital stock $30,000,000; by W. B. Cline, C. S. Vance, C. A. Luckenbach, T. P. McCrea, W. E. Houghton, H. R. Austin and C. P. Houghton.

LOS ANGELES, CAL.—Preliminary to a merger of all the light and power companies of Southern California the Los Angeles Gas & Electric Company has reorganized, substituted the word "corporation" for "company," and increased its capitalization to $30,000,000. The officers remain the same. Regarding the new corporation, President Cline says: "As soon as the papers of incorporation are granted we shall make an offer for the Pasadena Consolidated Gas and Electric Company and hope to take it over within 90 days. Eventually we will endeavor to obtain all the minor plants about Los Angeles and merge all into one concern."

TRANSMISSION.

LOS ANGELES, CAL.—Amos A. Fries of the U. S. Engineer's office has under consideration the application of the Edison Electric Company to build a high span power line over the channel between Wilmington and Long Beach harbors.

MONTAGUE, CAL.—The Siskiyou Electric Power and Light Company is making rapid progress in the construction of the new power line to Dunsmuir. It has a large force of men erecting poles near the town of Ager, and expects to have the line completed by September 1st.

VANCOUVER, B. C.—The Stave Lake Power Company, near Vancouver, has been absorbed by a new $5,000,000 company, the Western Canada Power Company, which expects within 18 months to be able to deliver 30,000 electrical horsepower to this district. At present there are about 60 men employed constructing the dam and plant, but a much larger force will be put to work almost immediately in order to hurry the work.

SPOKANE, WASH.—The Columbia Water Power Company, of which Sam Berry, J. B. Valentine and Sidney Berry are the principal owners, has plans prepared for harnessing the waters of the Methow river for power purposes. A large dam will be built and water conveyed in a flume, about a mile, to a power plant which will be erected at a cost of $50,000. From the latter a high power tension line will convey power to Bridgeport, Brewster, Pateros, Methow and other towns.

FRESNO, CAL.—Manager A. G. Wishon of the San Joaquin Power Company has returned from Los Angeles, where he has been ill for the past month. The detailed plans for the new work will be out in about ten days, when Mr. Wishon will go to Los Angeles to go over them with the engineers there. A survey of a ditch at Crane Valley has just been completed, and a considerable portion of the ditch has been finished. Equipment for the building of a dam to give ten times the present storage capacity is now being sent to the ground, and other equipment running up to a total of $50,000 is going through to the hills, to be used in the construction work. Among other enlargements will be the increasing of the old plant from a capacity of 2500 h. p. to a total of 17,000 h. p.

TELEPHONE.

FERNIE, B. C.—The East Kootenay Telephone Company is putting up a new office building.

NAPA, CAL.—William G. Furber and others have been granted a right to string telephone wires on certain roads in this county.

BUTTE, MONT.—At the annual meeting of the stockholders of the Montana Independent Telephone Company it was decided to build a long distance line from Missoula to Wallace.

ILLUMINATION.

KENDRICK, IDA.—A franchise has been granted to the Kendrick Gas Company to furnish gas to residents of the town.

BENSON, ARIZ.—Manager Frank Treat of the Benson Water Company states that the company plans for an early installment of an electric light plant.

SEATTLE, WASH.—The Council has passed a resolution providing for installing lights in Eighteenth avenue and other streets within certain described limits.

BELLINGHAM, WASH.—O. E. Booby and H. W. Swain have applied to the county commissioners for electric light franchises in Moocksack and Everson.

AZUSA, CAL.—The City Council has passed an ordinance granting to C. S. S. Forney the right to construct underground conduits, mains and gas pipes in this city.

PHOENIX, ARIZ.—John W. Sharpe has applied to the City Council for a franchise to construct and operate a gas and electric light plant in this city.

PASO ROBLES, CAL.—H. DeC. Richards, manager of the light plant of this city, has sold his interest to F. D. Frost, who will take charge as manager on July 1st.

SAN FRANCISCO, CAL.—Workmen have begun placing the ornamental lighting poles in Market street which the United Railroads agreed to donate to the city.

LOS ANGELES, CAL.—A branch manufacturing plant will be established in Los Angeles by the Pres-to-lite Gas Company of Oakland. A half-acre plot of ground in the southeast section of the city has been procured as a site for the factory.

ELLENSBURG, WASH.—Plans were formulated at a special meeting of the city council for doubling the capacity of the lighting plant. Bids will be called for a 250 h. p. steam engine and a 500 k. w. generator. If necessary, Councilman Wright, a practical mechanic, and Mr. Liverich, superintendent of the plant, will go to Seattle to investigate boilers and generators.

SAN FRANCISCO, CAL.—The contract for street lighting during the coming fiscal year was awarded by the artificial lights committee of the Supervisors to the San Francisco Gas and Electric Company, the bidder, at a figure which will amount to about $340,000. The figures are considerably lower than last year.

SAN FRANCISCO, CAL.—The City Electric Company is making a very large addition to its power station at North Beach. It has awarded a contract for construction of a concrete building on the west side of Mason street, 107 feet north of Beach street, covering at lot 30x137 feet, which it purchased about two weeks ago. The additional station will increase the capacity of the plant materially and enable the company to meet the demands upon it from patrons in the north end of the city.

OIL.

SAN FRANCISCO, CAL.—The Section Thirty Oil Company intends to change its place of business from San Francisco to Coalinga.

LOS ANGELES, CAL.—A franchise has been granted to the Union Oil Company by the council for a pipe line along Willow and Santa Fe streets on the company's bid of $150.

MORON, CAL.—The Standard Oil Company is at the present time pumping water into Midway instead of pumping oil out. Only one day in the month is the oil pumped out through the pipe line. It is also authoritatively reported that the Standard has refused to transport the fine grade oil of the Crandall company out of the country.

LOS ANGELES, CAL.—Independent oil producers met last week at Bakersfield to act upon final steps in financing of the Port Harford pipe line. The Producers' Pipe Line Company and Union Oil Company, will submit this proposition. L. P. St. Clair is president of the concern; W. L. Stewart, vice-president; H. H. Welsh, treasurer. Giles Kelloff, secretary.

PLEASANTON, CAL.—Determined efforts to thoroughly test the petroleum and natural gas fields east of this place are soon to be made. Agents of prominent capitalists in Oakland and other Pacific Coast cities have been recently employed to secure options and leases on farms in the Pleasanton district. An oil basin installed a few weeks ago at a seepage point on one of these farms was quickly filled with crude petroleum having a paraffine base. Four gallons of this oil was taken away by an expert. Several wells will shortly be sunk in the district.

LOS ANGELES, CAL.—The backers of the $3,000,000 independent oil-pipe line from the San Joaquin Valley fields to Port Harford are M. L. Requa of Oakland, Fred Bardley and William Crocker of San Francisco, Ogden Mills of New York, George Wingfield and U. S. Senator Nixon. Two hundred and thirty miles of 8-inch pipe has been bought here from an Ohio company. The pipe line is assured of 15,000 to 20,000 barrels a day to transport. With the minimum charge of 7½ cents the smaller amount will yield a revenue of $1125 a day. At the maximum of 22½ cents the amount will be $3375, besides the income from water transportation.

WATSONVILLE, CAL.—James D. Rickard is here from a visit of inspection to the Alvarez Oil Company's property in southwestern San Benito County. He states that the work on the big derrick being constructed for the Alvarez Company is going ahead rapidly under direction of Superintendent Edward Heron. The work will be completed within a few weeks and by July 1st boring operations will be commenced. The location of the well on the 700-acre tract of land will be about midway between the Lonoak Oil Company's well and the prospect wells bored on the Alvarez ranch several years ago. Mr. Rickard states that the Lonoak Oil Company, which recently had to cease boring on account of a mishap, has again resumed. The present depth of the well is 1769 feet, the drills are now going through a brown shale. This well encountered a good flow of oil in shale formation at the depth of 700 and 1200 feet, but the directors decided to go deeper for the black oil sand, and Expert Henderson says it is not far away.

TRANSPORTATION.

WALLA WALLA, WASH.—Preliminary work is being done for the extension of the line of the Walla Walla Valley Traction Company on Cherry street.

LOS ANGELES, CAL.—H. E. Huntington has asked for a street railway franchise for the Pacific Electric on Sixth street between Olive and Figueroa.

SALINAS, CAL.—An ordinance was passed by the Board of Supervisors granting H. R. O'Bryan a franchise to construct a street railroad in the county of Monterey, Cal.

FRESNO, CAL.—A. G. Wishon in a message from Los Angeles, declares that there is absolutely no truth in the published report that Harriman has bought the Fresno street railway.

EVERETT, WASH.—J. T. McChesney reports that the Everett & Cherry Valley trolley line which he has surveyed into the Snoqualmie country will probably be built this summer and will run as far as Tolt.

SACRAMENTO, CAL.—Contractor Harry J. Gray of this city was the successful bidder for the construction work on the Central California Traction Company's line to Agricultural Park, a distance of three and one-half miles.

VANCOUVER, WASH.—The Vancouver Traction Company, through its general manager, A. Welch, of Portland, announces that it will build a line from Vancouver to Orchards, a distance of six miles, if it is given a bonus of $10,000 and free right of way.

McKITTRICK, CAL.—The King Oil Company has ceased operations and will abandon its work. On this lease the drills went into water at 1480 feet. After this circumstance the company's management decided that to proceed further would be useless expense.

COALINGA, CAL.—The American Petroleum Company is enlarging its boiler plant and will install six 100 h. p. boilers. It has one 55,000-barrel steel storage tank completed, and another nearing completion, and the foundation about ready for the third tank.

LOS ANGELES, CAL.—The backers of the $3,000,000 independent oil-pipe line from the San Joaquin Valley fields to Port Harford are M. L. Requa of Oakland, Fred Bradley and William Crocker of San Francisco, Ogden Mills of New York, George Wingfield and U. S. Senator Nixon. Two hundred and thirty miles of 8-inch pipe has been bought from an Ohio company. The pipe line is assured of 15,000 to 20,000 barrels a day to transport. With the minimum charge of 7½c, the smaller amount will yield a revenue of $1125 a day. At the maximum of 22½c the amount will be $3375, besides the income from water transportation.

DENVER, COLO.—The Colorado & Southern railroad is preparing to electrify its South Park, Clear Creek and other mountain lines, and part of its Denver terminals. John F. Stevens, late vice-president of the New York, New Haven & Hartford, is expected here soon to make an official report on the project. Plans have about been completed for the construction of a plant at Mill Gulch, on the South Platte. The South Platte Power Company is the name of the corporation that is preparing to construct the plant. H. C. Jahl, an electrical engineer from the East, is in charge of the power project. The plant is expected to generate 20,000 horsepower and will cost approximately a million dollars.

WATER WORKS.

LOS ANGELES, CAL.—C. S. S. Forney has been awarded a franchise to lay gas mains in this city.

SEATTLE, WASH.—Sealed bids are being received for the construction of water mains in Eighth avenue south and other streets.

UPLAND, CAL.—The Ocean View Land and Water Company will build a pipe line system here with an intake well up in the canyon.

MEDFORD, ORE.—The City Council has adopted resolutions providing for laying four and six-inch water mains in a large number of streets.

MAYFIELD, CAL.—The request of R. A. Crothers to have water mains extended to his property in Evergreen Park, has been granted by the Trustees.

AUBURN, CAL.—The Roseville town trustees and fire commissioners Thursday went over their city and selected locations for 17 new fire plugs.

PRESCOTT, WASH.—Mayor Uttor, Councilmen Marr and Barclay and Marshal Fisher are investigating the matter of laying a new 12-inch pipe line.

KONT, WASH.—An ordinance has been passed calling an election July 12 to vote on the question of issuing bonds for building a municipal water system.

MINDEN, NEV.—The application of the H. F. Dangberg Land & Live Stock Company, for a franchise to install a pipe line in the town of Minden, has been granted.

TACOMA, WASH.—The Council has adopted resolutions providing for 6 and 8 inch cast iron water mains in Pine, Lawrence and other streets, at a cost of $18,784.70.

GARDNERVILLE, NEV.—The application of the Virginia Ranch, Land & Cattle Company for a franchise to install a pipe line in Gardnerville has been granted.

PORTLAND, ORE.—Engineer Clark of the water board has been instructed to draw up a report on the feasibility of laying a pipe line across the river on the new Madison street bridge.

SAN FRANCISCO, CAL.—The Comstock pumping association has appropriated from its treasury surplus $25,000 to be used in equipping the Ward shaft with two new pumps of the plunger type.

PORTLAND, ORE.—Sealed proposals will be received by the water board of the City of Portland up to July 12 for furnishing 5,000 water meters of the following sizes: 4500 ⅝-inch, 300 ¾-inch and 200 1-inch.

PORT TOWNSEND, WASH.—The council has received a communication from the Moore Investment Company operating at Irondale, petitioning for an extension of the city pipe line to the manufacturing district across the bay.

ALAMEDA, CAL.—The Alameda City Council has appointed a committee consisting of Councilmen E. B. Bullock, John Walter and William Hammond, Jr., to determine the expense of installing an auxiliary salt water pumping plant.

SAN DIEGO, CAL.—A Los Angeles syndicate headed by A. W. Sherman and the California Colonization Company, has purchased the Fortuna ranch, in Mission Valley, northeast of the city. The company will install a large pumping station.

SAN FRANCISCO, CAL.—The Spring Valley Water Company has made formal request of the Supervisors that they abandon the two water rights of way across the Lake Honda reservoir tract granted twelve years ago by the corporation to the city.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded the contract for manufacturing 1200 hydrants for the auxiliary fire system to the Union Iron Works at a cost of $119.74 each, making the total value of the contract, $134,388.

LOS ANGELES, CAL.—Sealed bids will be received at the office of Treasurer Pacific Branch, N. H. D. V. S. Soldiers' Home, July 22d for furnishing pipe for the new system from Readworks in Mandeville Canyon, to the service reservoirs in accordance with specifications.

ATHENA, ORE.—The Athena Water Commission has let a contract amounting to $1275 to the Fairbanks-Morse Company for equipment, consisting of a 40 h. p. electric motor and a Byron Jackson turbine pump with a capacity of 350 gallons a minute under 120 pounds pressure.

ABERDEEN, WASH.—Sealed proposals will be received up to June 30 for 200 ¾-inch extra heavy brass round way curb cocks, 200 ¾-inch black maleable unions, 200 ¾-inch wrought nipples, 200 ¾-inch maleable street ells, 100 1-inch maleable street ells, 100 1-inch by 3-inch wrought nipple.

MADERA, CAL.—City Engineer Smith has completed plans and specifications for the new water works which have been adopted by the Board. The plans call for an automatic system of 140,500 gallons capacity. A resolution has been adopted calling for bids for the construction of the water works, bids to be opened on July 19.

SAN FRANCISCO, CAL.—The Board of Public Works has received five proposals for the gate-valves of the fire protection system. The bidders and the amounts follow: Pittsburg Valve Company, $342,398.50; Union Iron Works, $452,472.50; Pelton Water Wheel Company, $398,698.10; Crane Company, $469,061.50, and the Lally Company, $421,857.60.

INDEPENDENCE, CAL.—The Board of Directors of the Independence Water Company have decided to make extensive improvements in the water system by building a cement reservoir with a capacity of 300,000 gallons. New eight-inch mains will be placed in the principal streets and the pipe line will be extended a quarter of a mile further north and about 700 feet further east.

FRESNO, CAL.—J. P. Clark has associated himself with J. A. McClurg, Truman Hart, F. M. Helm, A. W. Anderson of Fresno and William Hinkel of San Francisco, for the purpose of investing $500,000 in a water system for the Midway field, obtaining the water from Buena Vista Lake. Sites for wells have been secured at each end of the lake and prospecting for water is now in progress. The trunk line will run past the point of the Buena Vista hills through the northern portion of the Maricopa district and thence to the highest ground in the Midway field. There reservoirs will be built and water sufficient in amount to serve the fields for a considerable time will be stored. Duplicate wells and duplicate power stations are embraced in the plan, and every precaution will be taken to guard against interruptions.

FINANCIAL.

WILBUR, WASH.—The electors have voted $4100 in bonds for making improvements in the local waterworks.

SUNNYSIDE, WASH.—The State of Washington has bought the $15,000 worth of water bonds recently voted by this place.

GLENDALE, CAL.—The bond election for issuing $60,000 worth of bonds for a new municipal lighting plant was carried by a majority of 170 votes.

McMINNVILLE, ORE.—Thirty thousand dollars has been voted to complete the new electric light plant here and to improve the gravity water system.

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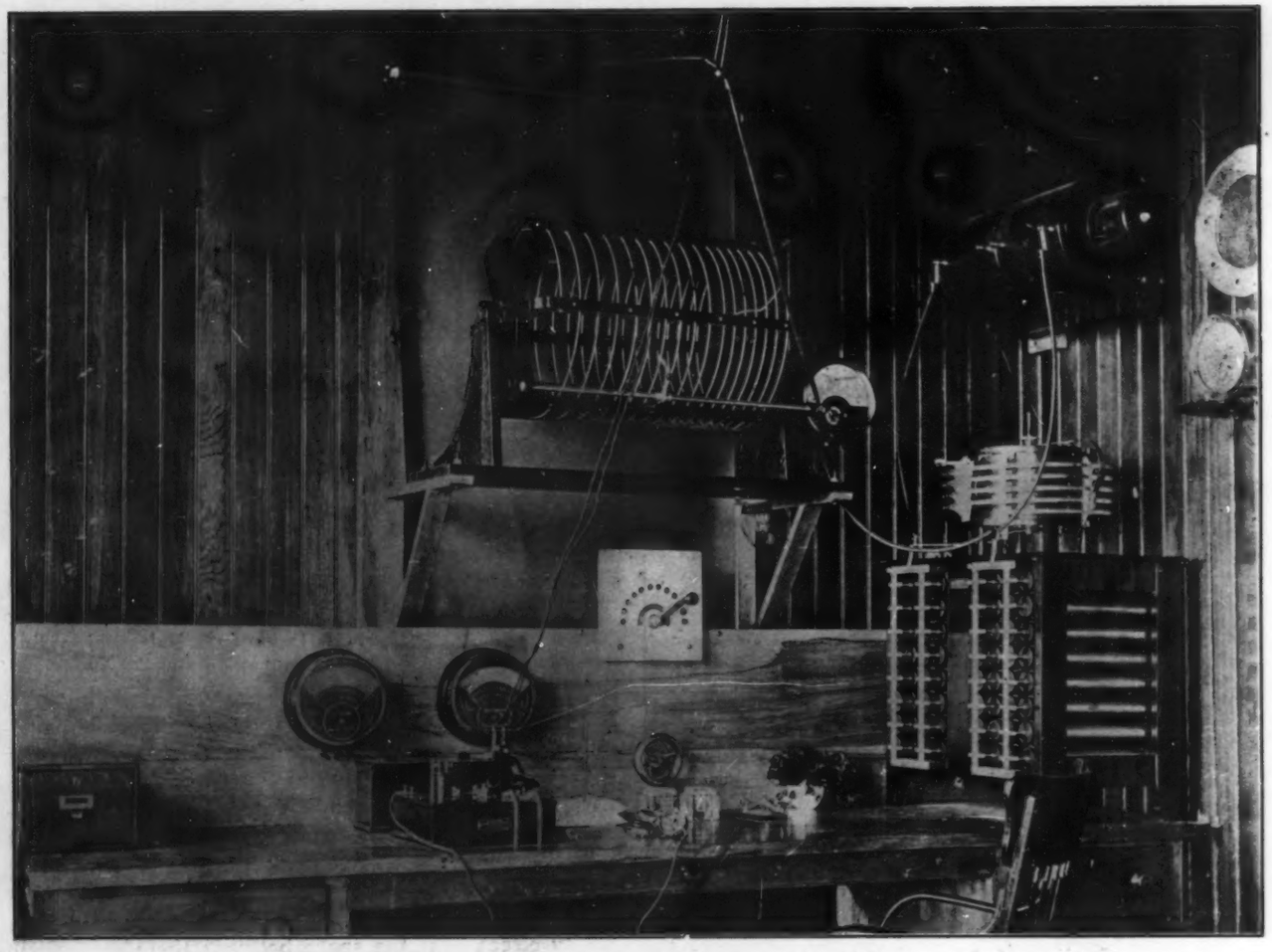
WIRELESS TELEGRAPHY.[1]

BY O. P. GULDEMEISTER.



Typical Wireless Telegraph Station

The term wireless telegraphy is commonly used in contradistinction to the electric telegraph in which it is necessary to employ a wire as an artificial conducting medium between stations. Nature provides a medium, called ether, through which intelligence may be communicated over sea or land; and by means of which otherwise impossible results are accomplished. The ether exists between the planets and the stars, and all the other heavenly bodies, and has no conceivable end. Transmission of energy through the ether takes place in the form of wave motion, and these waves are known as electromagnetic waves. Light, heat, and wireless waves differ in their relative rates of vibration; their velocity. They do not, however, traverse all substances with like velocities.

The basic principle of wireless telegraphy is in the disturbance of the ether, setting up wave motions. To illustrate this wave motion, let us suppose a small pond

[1]Paper read before Portland Section A. I. E. E., May 18, 1909.

of still water with a stick of wood floating upon its surface. If a stone should be thrown into the water, it would cause to set up small waves radiating from the point of impact of the stone with the surface of the water. These waves are strongest at the center from where they are caused to be radiated and grow weaker as the circles grow larger and as distance increases. As the waves arrive at the point where the chip is floating, they will impart motion to the chip. From this experiment it will be seen that the distance over which signals may be sent by this means will depend upon the force employed to start the waves and upon the lightness of the chip, or its sensitiveness to the motion of the waves. If there were grass or other obstructions in the pond, some of the energy would be absorbed in swaying the grasses, hence the effect upon the chip would not be so great and the signaling distance lessened.

When it is considered that these water waves cover an ever increasing area as the circles expand, and that the actual energy which disturbs the chip is an extremely small part of the total energy in the entire circular wave, it should be clear why so great an amount of energy is required at a wireless station in order to operate a sensitive receiver many miles away.

For another experiment let us suppose a still pond of water with two suspended weights touching the surface of the water and supported from some place where they are free to move. If we are to set one of these weights in motion by pulling and releasing the spring, wave motions are set up on the surface of the water which are transmitted to the other weight on the receiving end. This latter weight will be set in motion by reason of the first weight setting up wave motions If properly adjusted, they will correspond and oscillate at exactly the same frequency. In wireless telegraphy the oscillations of the frequency between sending and receiving station must harmonize for successful operation.

In order to create wireless wave motions by electrical means we must have an alternating current of low potential, a step up transformer for changing the low potential alternating current into low frequency, high pressure currents, means for transforming these into high frequency, high pressure oscillations and necessary means of utilizing these oscillations to form the electromagnetic waves.

At the receiving end means must be provided for intercepting these waves and transforming them into electrical oscillations and transforming these into readable sounds.

Outline of Apparatus Used.

The principal apparatus in the sending station is a transformer. Some years ago the induction coil was used, but on account of the low efficiencies of these coils the transformer has become standard.

The ordinary capacities of commercial stations is 2 to 3½ kilowatts. The primary input generally is 110 volt a. c. and the secondary output from 40,000 to 75,000 volts. All of these transformers are submerged in oil. Sometimes the primary is wound in sections so that it can be operated in series or parallel.

The telegraph sending key must be a heavy key, capable of carrying a high amperage without undue heating. The contacts are generally made of silver, to prevent burning and melting together when carrying large currents.

A variable reactance is used in the primary circuit to allow for current regulation. The frequency delivered at the terminals of the secondary of the transformer is not sufficiently high enough to generate the wireless waves. A frequency of at least 100,000 vibrations per second is required to form the wireless waves and in order to produce them a condenser is employed for this purpose. The condenser is generally made of heavy glass plates and tin foil. The function of the condenser is to change the frequency from a low oscillating current into a current of very high frequency. When the terminals are connected to the transformer, the tin foil will receive and retain a charge of electrical energy equal to the source from which it is supplied. After it has become fully charged, a discharge takes place across the terminals of the spark gap in the form of a spark which, while appearing to be single and momentary, has been found by experiment to consist of alternating flashes in rapid succession, each flash lasting less than one hundred thousandth part of a second. The frequency of these oscillations is regulated by the capacity of the condenser; the smaller the capacity the higher the frequency.

A spark gap is provided over which the high frequency currents discharge. They are adjustable and can be set to any desired distance. While the discharge takes place, a large amount of ozone is generated and means should be provided to get rid of this ozone as it forms a high insulator for the passage of the high frequency currents.

Another important apparatus necessary in the sending station is a variable inductance which is usually wound upon a wooden frame with a dozen turns of ⅛-inch copper wire. Means are provided for making quick connections at any point of the inductance coil.

There is probably no other piece of apparatus which is of so much importance in wireless signaling as the antenna or aerial. A tall mast supports a group of wires which are connected to the variable inductance coil. The antenna wires are grouped together in parallel to form an electrical capacity which disturbs the earth's magnetic field. The length of the antenna varies according to conditions. Numerous experiments were made on antennae of large capacity and it was found instead of using sheets of solid metal or wire netting, single wires could be placed a short distance apart and yet give practically the same capacity effect as if the space between them were filled with solid conductors.

The higher the antenna wire extends into the earth's magnetic field, the more contact it makes with the upper ethereal belts which carry the wireless waves. The wireless waves seem to traverse the upper atmosphere with much greater ease than the lower ones, as they meet with fewer obstructions and hence the importance of erecting high antenna wires. One of the most important features of operating a wireless sending station is to have the circuits properly tuned and in synchronism. It is necessary to have the oscillations of the condenser in synchronism with the antenna circuit. The adjustment is made on the in-